HEART OF BORNEO

INVESTING IN NATURE FOR A GREEN ECONOMY

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Christopher E. Cosslett, Andy Dean

Published by WWF HoB Global Initiative

“The perilous future facing nature is our own making, but the solution is also within our grasp.”

Edward O. Wilson

Heart of Borneo: Investing in Nature for a Green Economy has been developed in support of the three-country Heart of Borneo (HoB) Initiative. It includes three products: the present main report — *Heart of Borneo: Investing in Nature for a Green Economy*, the synthesis report and a related website **(www.hobgreeneconomy.org)**.

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This project was possible thanks to funding from the European Space Agency and WWF

Designed by Catalyze Sustainability Communications and ActivDesign
Cover photos (from top to bottom): © Alain Compost / WWF-Canon, © Heinz Terhorst, © WWF-Indonesia
Published: May 2012 by © WWF HoB Global Initiative

Please refer to this publication as follows: Van Paddenburg, A., Bassi, A., Buter, E., Cosslett C. & Dean, A. 2012. *Heart of Borneo: Investing in Nature for a Green Economy*. WWF Heart of Borneo Global Initiative, Jakarta.

ISBN number: 978-602-19901-1-7

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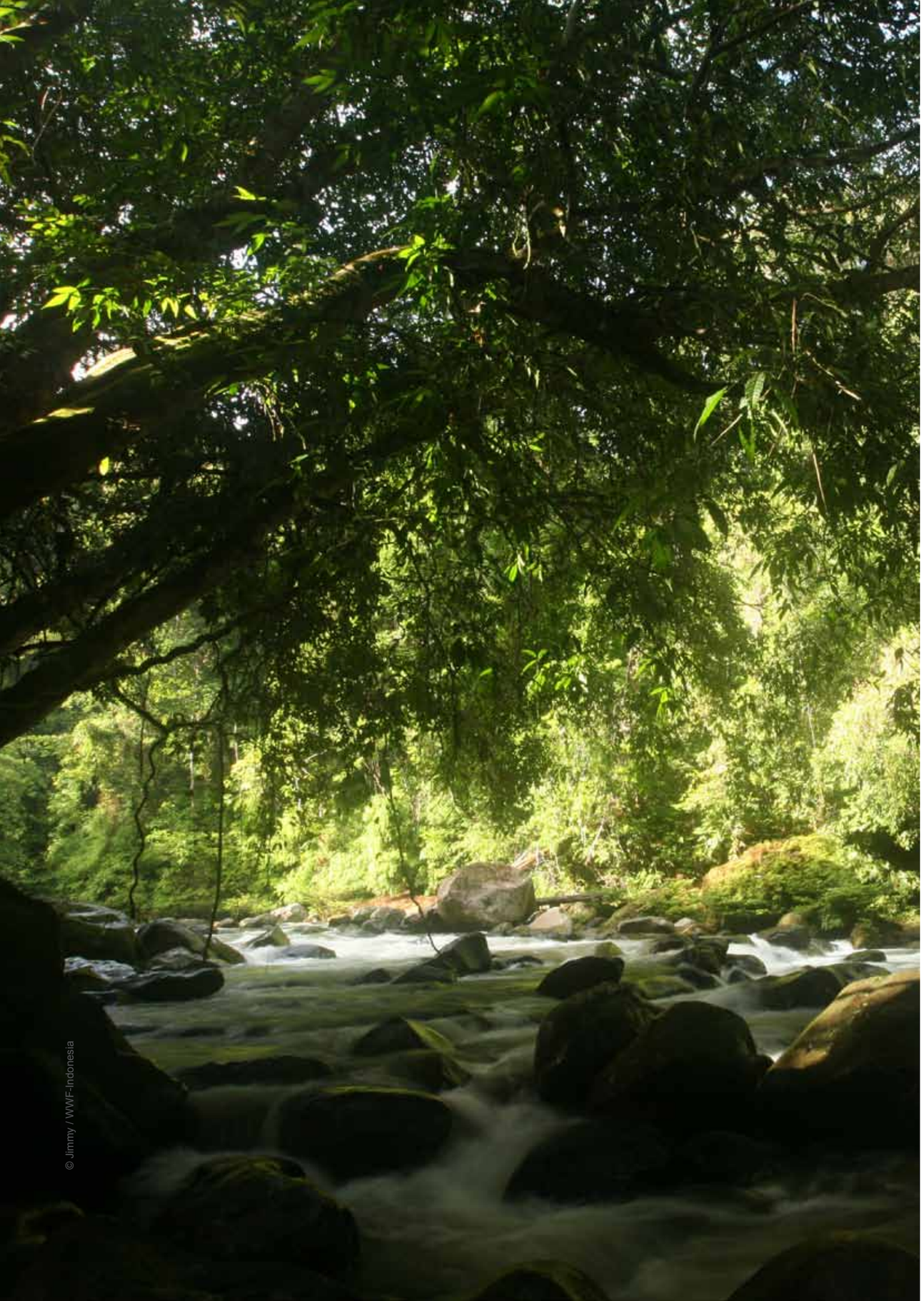


FOREWORD
BY SIR DAVID ATTENBOROUGH

Life on Earth is not evenly spread around our planet. Borneo–the world's third largest island–is one of its richest treasure houses, full of an immense variety of wild animals and plants, all living in a magnificent tropical forest.

A vast area of this forest still cloaks the mountains, foothills and adjacent lowlands that stretch along the borders of Brunei Darussalam, Indonesia and Malaysia. This is the Heart of Borneo and all of us who value life on this planet should support the efforts of these countries to conserve it. It is truly a world heritage and the world should respond to its needs.

Like almost all such forests, it is threatened by being cleared or degraded, due to the economic and social pressures of life in the 21st century. Unsustainable logging, clearance for agriculture and mining, and the increasing impact of climate change are all taking their toll. Borneo is in danger of losing valuable ecosystems that are important to the survival of local communities and to the national economies of all three Bornean countries, as well as being a vital part of the global effort to combat climate change.

Borneo's forests are huge stores of natural capital. We harvest their timber and non-timber products from a staggering array of plants and animals. We enjoy their amenities and market them for ecotourism. We depend on their water for our homes, farms, industries and transport; and we depend on their ability to store carbon and so mitigate the build-up of greenhouse gases in the atmosphere.

In spite of this, until now we have put almost no effort into calculating their worth. Forests are natural capital that we can ill afford to squander, yet we don't know the true value of what we have in our 'natural bank'. Conventional national accounts give us GDP and other measures, but they fail to measure things that are not paid for in cash, no matter how valuable they are and no matter what the monetary costs would be if we had to replace them.

This report addresses this oversight. It takes the first steps towards quantifying the unseen value of nature in the Heart of Borneo and tells us that with concerted action, a green development pathway is indeed possible, with greater benefits for everybody, including indigenous communities and the poor. It presents a beacon of hope, with conservation, development and economic growth going hand in hand.

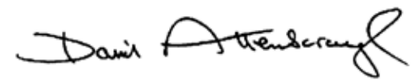
In order to implement its message, the real value of natural capital must be reflected in both fiscal planning and the prices of goods and services. There must be financial incentives to stimulate the proper husbandry of natural resources, with realistic valuations given to the crucial issue of the growth of low-carbon markets and sustainable, pro-poor economies. Carbon finance through REDD+ can be a key mechanism to safeguard the forests and unlock their true value.

Governments must take the lead and work with civil society, indigenous groups and the private sector to make sustainable forest management financially worthwhile. The Heart of Borneo is an excellent place to begin.

We urgently need a new path towards a sustainable future–one which places a true economic value on nature's gifts and the role they play in providing us with the necessities of life.

This report will help us to get closer to creating the green economies that will ensure food, water and energy security for all.

Managing forests sustainably needs to become a universal political priority. Protecting biodiversity protects all our futures and the Heart of Borneo can be an example to the world of how this can be achieved.



ACKNOWLEDGMENTS

The authors—Annawati van Paddenburg, Andrea Bassi, Eveline Buter, Christopher Cosslett and Andy Dean—would not have been able to complete this report without the commitment and dedication of dozens of contributors. The authors are very grateful to experts from around the world for their contributions to this important knowledge product.

Significant contributions have come from Siti Ichsan (WWF-Indonesia), Brendan Fisher (WWF-US), Joshua Bishop (WWF-Australia) and Andrea Westall (WWF-UK), as well as many resource persons in Brunei, Indonesia and Malaysia as well as across the globe. A special thanks to all below, who have contributed to specific sections in the report.

Thomas Barano (WWF Indonesia),
Aditya Bayunanda (WWF-Indonesia)
Nirmal Bhagabati (WWF-US)
Arif Budiman (WWF-Indonesia)
Andrew Cuthbert (Hatfield)
Wiwin Effendy (WWF-Indonesia)
Cristina Eghenter (WWF-Indonesia)
Chris Greenwood (WWF-HoB Global Initiative)
Irwan Gunawan (WWF-Indonesia)
Merril Halley (New Forests)
Rosenda Kasih (WWF-Indonesia)
Mikaail Kavanagh (Brunei Advisor, HoB Global Initiative)
Yuyun Kurniawan (WWF-Indonesia)
Arif Data Kusuma (WWF-Indonesia)
Belinda Lip (WWF-Malaysia)
Hermas Maring (WWF-Indonesia)
Doni Prihatna (WWF-Indonesia)
Hermayani Putera (WWF-Indonesia)
Tri Agung Rooswiadji (WWF-Indonesia)
Amy Rosenthal (WWF-US)
Wisnu Rusmantoro (WWF-Indonesia)
Agus Salim (Hatfield)
Hans Smit
Jessica Spence
Jeanne Stampe (WWF Singapore),
Julian Syah (Witteveen+Bos Indonesia)
Zhuohua Tan (Millennium Institute)
Heinz Terhorst (GIZ, HoB For Clime Project)
Albertus Tjiu (WWF-Indonesia)
Adam Tomasek (WWF-HoB Global Initiative)
Dinda Trisnadi (WWF-Indonesia)
Budi Wardhana (WWF-Indonesia)
Ambang Wijaya (WWF-Indonesia)
Made Wiratma (General Electric GE Energy)
Ivy Wong (WWF-Malaysia)
Stephan Wulffraat (WWF-Indonesia)

We would also like to thank the following for their constructive comments and guidance on drafts of the report as well as analytical and communications advice.

Mark Aldrich (WWF-International)
Jonathan Cook (WWF-US)
Naikoa Aguilar Amuchastegui (WWF-Forest Climate GI)
Diana Anthony (WWF-Malaysia)
Nancy Ariani (WWF-Indonesia)
Anita Beck (UNEP-TEEB)
Emily Benson (Green Economy Coalition)
Andrew Bovarnick (UNDP)
Esteban Brenes (WWF-US)
Francine Brondex (UNEP-TEEB)
Ernest Chiam (WWF-Malaysia)
Katie Critchlow
Jonathan Davies
Hans Dols (Shell)
Rob Evans (PWC)
Nazir Foead (WWF-Indonesia)
Oki Hadian (WWF-Indonesia)
Iain Henderson (WWF-Forest Climate GI)
Chloe Hill (UNEP-TEEB)
Paul Hultera (WWF-Indonesia)
Nyoman Iswarayoga (WWF-Indonesia)
Rashida Maqbool (WWF-Malaysia)
Alex McBratney (University of Sydney)
Emily McKenzie (WWF-US)
Jian-hua Meng (WWF-Germany)
John Morrison (WWF-US)
Ginny Ng (WWF-US)
Olsen Nathalie (IUCN)
Tania Paratian (WWF-International)
Tehani Pestalozzi (WWF-International)
Anwar Purwoto (WWF-Indonesia)
Ramakrishna Sundari (WWF-Malaysia)
Maria Ratnaningsih (Universitas Indonesia)
Dave Savory (BHP Billiton)
Retno Setiyaningrum (WWF-Indonesia)
Aurelie Shapiro (WWF-Germany)
Jane Spence (WWF-HoB Global Initiative)
Saradambal Srinivasan (WWF-Malaysia)
Agus Sari (UKP4)
Klaas-jan Teule (WWF-Indonesia)
Hans Thiel (FAO)
Elisabeth Wetik (WWF-Indonesia)
Noverica Widjojo (WWF-Indonesia)

Finally, we are especially grateful to the following people who made various workshops and dialogues possible, strengthened these workshops with their expertise and contributed to the success of these events. Many have also provided inputs into the report. For a list of key stakeholder participation processes, see Annex 1.

Mubariq Achmad (World Bank)
Muam Ahmad (UKP4, GoI)
BustanulArifin (INDEF)
Chris Hails (WWF-International)
Raldi Hendro Koestoer (CM of Economic Affairs - GoI)
Frederick Kugan (Sabah Forestry Department - GoM)
Datuk Sam Mannan (Sabah Forestry Department - GoM)
Efransjah Nasution (WWF-Indonesia CEO)
Andi Novianto (CM of Economic Affairs - GoI)
Ravi Prabu (UNEP)
Heru Prasetyo (UKP4 - GoI)
Singgih Riphat (Ministry of Finance - GoI)
Emil Salim (Indonesia President Advisory Council)
Dionysius Sharma (WWF-Malaysia CEO)
Benjamin Simmons (UNEP)
Budi Situmorang (Ministry of Public Works - GoI)
Pavan Sukdev (GIST Advisory)
Satya Triphati (UNDP-UNORCID)
Rachmat Witoelar (Executive Chair DNPI- GoI)

This report would not have been possible without financial assistance from the European Space Agency and WWF.

Our sincere thanksgo to all of the above for their passion and commitment to the Heart of Borneo Initiative.

"The Heart of Borneo Initiative offers an important example of how countries can work together across borders to develop and implement a green economy vision. By investing in nature, countries in Borneo and beyond are helping to ensure a sustainable and equitable future for their citizens and for the world as a whole."

Fulai Sheng, Senior Economist, United Nations Environment Progam (UNEP)

"Investing in nature, particularly sustainable forest management, is a critical element in ensuring sustainable development. Recognizing the value of natural capital is a necessary first step in encouraging such investment."

Javed Hussain Mir, Director, Environment, Natural Resources and Agriculture, South East Asia Department, Asian Development Bank (ADB)

"The HoB is Indonesia's first National Strategic Area designation based on natural capital values. This unique landuse policy and planning framework provides the foundation for a forward looking vision to achieve conservation and sustainable development for nature and people's well-being. This report is a valuable resource that can support a green economy approach in Kalimantan."

Andi Novianto, Chairperson, Indonesia HoB National Working Group

KEY MESSAGES

- Home to approximately 6% of the world's biodiversity, the Heart of Borneo (HoB) is one of earth's richest biological treasure troves. HoB's forests cover upstream and midstream portions of 29 river basins and provide important ecosystem services across an area of 54 million ha, more than 70% of Borneo, benefiting over 11 million people.
- HoB's natural capital has tremendous social and economic value at local, national and global levels. This includes social values related to traditional knowledge and sacred sites, the value of biodiversity and ecosystems in creating resilience to a changing climate and the value of ecosystem goods and services used as inputs within multiple sectors of Borneo's economy. However, the many values of HoB's natural capital remains poorly recognized.
- While still of great importance, HoB's natural capital has been sharply eroded in recent years. As natural capital is lost, ecosystem goods and services decline. Climate change, coupled with deteriorating ecosystems and biodiversity from land use change, is having further impacts, including sea level rise, risk of floods and fires and changes in the duration and intensity of wet and dry seasons.
- Borneo's economy is currently neither supporting readiness for climate change nor adequately serving the needs of its people. The unsustainable practices of one economic sector are having impacts on other sectors and on local people. Few industries are taking into account the high costs of reduced or lost ecosystem services, which are eroding their long-term economic prospects and viability. According to a Business-as-Usual (BAU) scenario, by 2020 the environmental costs of economic growth are estimated to outweigh revenues from natural capital.
- The many values of HoB's natural capital—including its critical role in the economy, in supporting broader human welfare and in creating resilience to climate change—remain poorly recognized. Traditional economic measures such as GDP fail to account for natural capital's role in determining productivity, while most ecosystem goods and services lack markets and prices.
- Shifting to a green economy that values and invests in natural capital would help to sharply reduce many of these negative trends, while supporting climate change mitigation and adaptation. Its creation depends on the incorporation of natural capital values into economic policies and private sector decision making.
- A modeling approach indicates that shifting to an alternative, green economy which recognizes the value of natural capital is feasible. The potential benefits of such a shift include reduced poverty, more rapid growth, stronger local economies and enhanced resilience to climate change. In the long term, growth will increase more rapidly under a Green Economy (GE) scenario where natural capital is sustained. A green economy is essential to ensuring long-term, sustainable economic growth and development.
- HoB is a prime example of a coordinated transboundary approach in which a green economy vision—as outlined in the HoB Declaration—is being transformed into reality. However, urgent action is still required by governments and other stakeholders, working in partnership. The cost of action is far less than the cost of inaction.

EXECUTIVE SUMMARY

Comprising approximately 30 per cent of the island of Borneo's land area, the Heart of Borneo (HoB) covers more than 22 million hectares of tropical rainforest across three countries: Brunei Darussalam, Indonesia (Kalimantan) and Malaysia (Sabah and Sarawak). It is the largest remaining expanse of transboundary tropical forest in Southeast Asia. Home to an astounding six per cent of the world's biodiversity, from the orangutan to the world's largest flower, and containing the headwaters for 14 of Borneo's 20 major rivers, the HoB is one of the planet's richest treasure troves. More than 500 new species, or about three per month, have been discovered within the HoB since 1995.

> **"With one conservation vision and with a view to promote people's welfare, we will cooperate in ensuring the effective management of forest resources and conservation of a network of protected areas, productive forests and other sustainable land-uses within an area which the three respective countries will designate as the "Heart of Borneo (HoB)."**
>
> ***Heart of Borneo Declaration (2007)***

The HoB Initiative is a transboundary collaboration among Brunei, Indonesia and Malaysia to enable conservation and sustainable development that improves the welfare of those living on the island while minimizing deforestation, forest degradation and the associated loss of biodiversity and ecosystem services. Under this initiative, the three countries have committed 355,000 hectares, 16.8 million hectares and six million hectares respectively to be included in the HoB. The commitments of the three HoB governments are contained in the Heart of Borneo Declaration.

A priority challenge facing the three governments—one highlighted in a recent three-country publication, *Financing the Heart of Borneo: A Partnership Approach to Economic Sustainability*—is the need to harmonize HoB plans and current national and sub-national development plans in order to reflect economic, social, climate, biodiversity and poverty reduction objectives. The publication highlights critical actions needed in order to integrate the value of forests, biodiversity and healthy watersheds into national and local development plans, while optimizing economic returns to improve people's livelihoods and national economies. When the three governments launched the above report at the UN Convention on Biodiversity in Nagoya (2010), the following next steps were agreed:

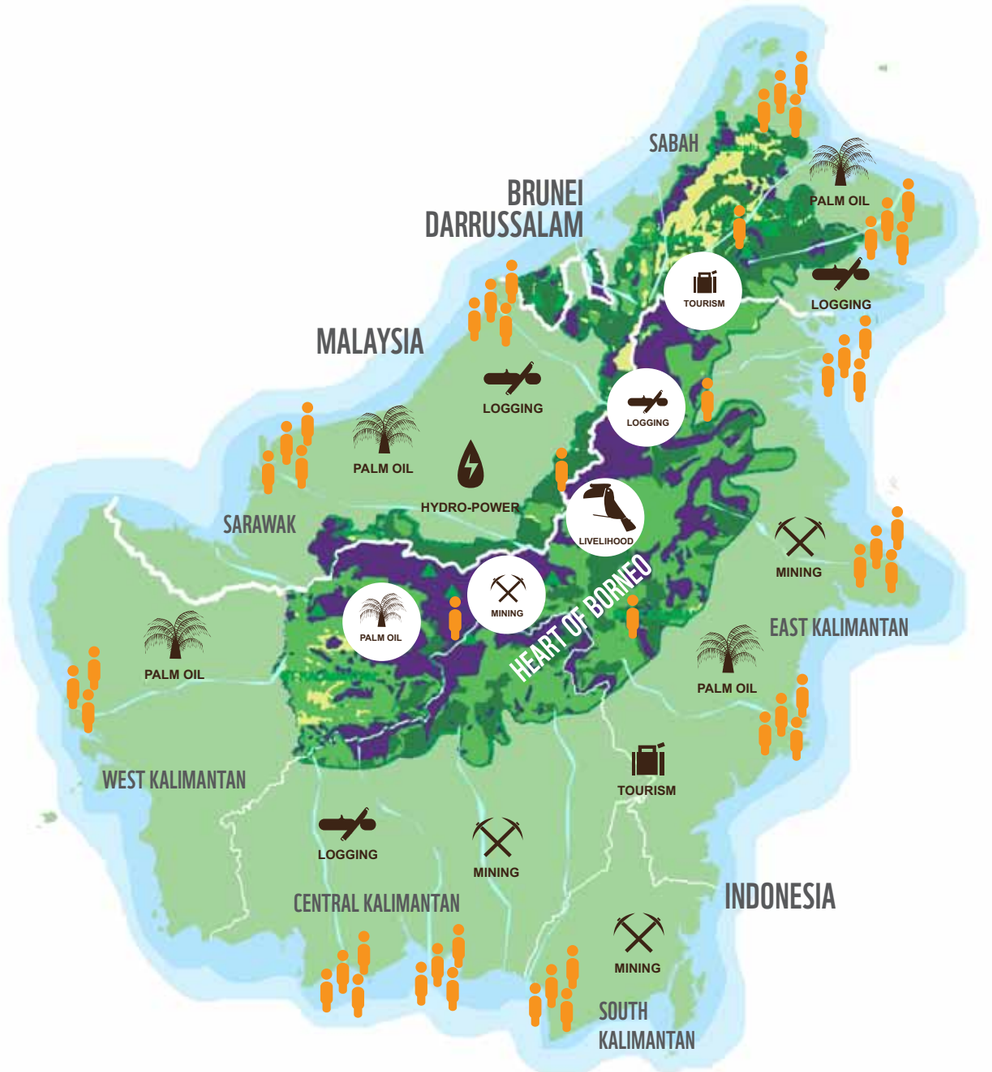
- Understand the value of forests, watersheds, biodiversity and potential for carbon emission reduction and distribution to beneficiaries;
- Assess how to optimize economic growth while maintaining HoB's natural capital and its contribution to climate change;
- Estimate the costs and benefits associated with sustainable landscape management;

The present report is designed as a specific contribution towards completion of the above-mentioned steps by helping to demonstrate the economic case for investing in natural capital for the benefit of Borneo's economies and people's well-being. Making this case constitutes a critical step in mainstreaming the value of HoB natural capital into economic decision-making processes.

Green growth assessment

UNEP's *Green Economy Report* (2011) defines a green economy as "...an economy that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities." This definition emphasizes reductions in carbon emissions and pollution, improvements in energy and resource efficiency and minimal or no loss of biodiversity and ecosystem services.

A key aspect of a green economy is its emphasis on sustaining 'natural capital' to secure green growth and long-term prosperity. Natural capital comprises the biosphere as a whole, including ecosystems and biodiversity and is an indispensable enabler of economic growth and human well-being. Key elements of HoB's natural capital are natural resources such as forests, minerals, soil and water; ecosystem goods, such as timber and a range of biodiversity-based



The Heart of Borneo plays a crucial role in today's economy

products; and ecosystem services, such as water supply and carbon sequestration provided by these resources. A green economy for the HoB is an economy in which the area's natural capital is sustained and, where possible, restored—with improved human well-being and social equity among the main results.

While many may agree on the importance of investing in natural capital in principle, competing demands over the allocation of public funds mean that adequate levels of investment may not easily be forthcoming. The case for investment in HoB's natural capital is currently undermined by the undervaluation of forest ecosystems and of the goods and services generated by them.

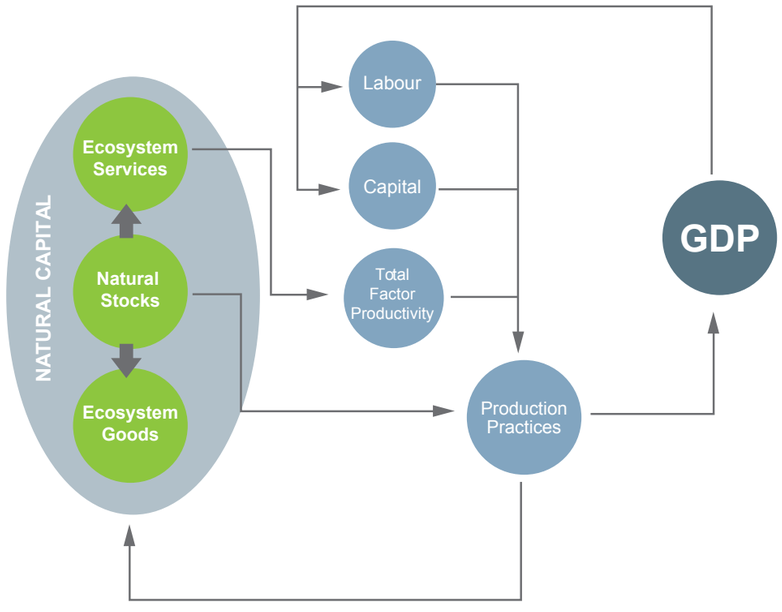
The present report is designed to draw the attention of policy- and decision-makers to the importance and value of HoB natural capital and to underscore the economic necessity of sustaining it through policies, regulations, incentives, investments and on-the-ground solutions. The report considers, among others, the following critical questions:

- How valuable are HoB's natural ecosystems and associated services to the economies of Brunei, Indonesia and Malaysia?
- Who profits from these ecosystem services?
- Who suffers from degradation or loss of these services?
- How can changes in regulations or incentives stimulate investment in sustaining forest ecosystems?
- What investments would be required to safeguard ecosystem services?
- Do the benefits of investing in sustaining ecosystems and biodiversity justify the costs?
- Does investing in sustaining ecosystems and biodiversity result in a more equitable distribution of benefits?
- Would investment in sustaining ecosystems and biodiversity support the reduction of poverty?
- Would investment in sustaining ecosystems and biodiversity benefit long-term economic growth?
- What are the likely short and long-term impacts of climate change on HoB's natural ecosystems and services and how should these affect decisions regarding investments in natural capital?

This report is based not only on the findings of analytical and modeling tools, but it is also fundamentally the result of a participatory-based approach involving green-economy-related workshops, dialogues and conferences held at national and regional level over a period of two years. A wide range of stakeholders representing national and sub-national governments, businesses, development partners, academia and civil society have participated and thus contributed to the report.

The economy – nature disconnect

Even though nature is ultimately the most essential resource underpinning any economy, standard economics and business-as-usual policies both fail to take into account its economic value. Ignoring the value of nature has inevitable long-term impacts, including resource depletion and environmental degradation. These in turn generate socio-economic costs and foregone revenue streams, while placing substantial burdens on society as a whole.



Conceptual model of the conventional economy which externalizes natural capital from production

Despite the economic and social values of HoB's natural capital and the high costs of poor management, the critical role of natural capital in the economy and in broader human welfare largely continue to be ignored. GDP measures fail to account for natural capital's important contribution to productivity. Few industries take into consideration the costs of reduced or lost ecosystem services. Policy continues to incentivize extraction. External costs remain external to those responsible.

The value of HoB ecosystems and biodiversity is poorly recognized because they are 'public' goods and services without markets or prices. The lack of incentives to conserve results in poor ecosystem management, impacts on ecological functions and, eventually, losses due to foregone revenue streams. Considerable investments may be required to offset the losses incurred.

The value of HoB ecosystems and biodiversity

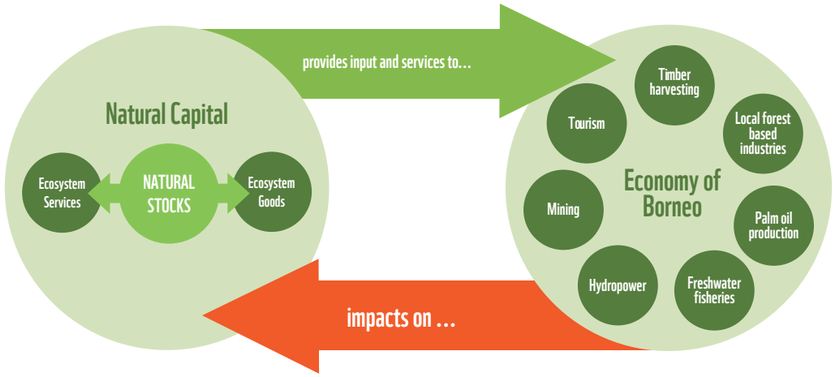
The HoB's treasure trove of natural capital creates value for people at local, national and global levels. The island's economy and well-being depends to an important extent on nature. The most obvious benefit is through the provisioning of natural resources to sustain industries and forest-dependent communities. The value of HoB's natural capital is also directly linked with the abundant range of goods and services that its ecosystems provide to people and to economies. Besides these, the local subsistence economy, as well as the economy at large, depend on less tangible services provided by HoB ecosystems.

Many aspects of the value of natural capital are difficult to quantify, such as social values related to traditional knowledge and sacred sites, or the value of biodiversity and ecosystems in creating resilience to a changing climate. HoB forest and aquatic ecosystems possess immense intrinsic value, independent of any products and services. This value is reflected in the rich socio-cultural heritage of the Dayak people, whose lives are closely intertwined with the forest. Finally, there is the pure recreational and existence value of the forests and the exotic, and often rare, species they harbour.

The HoB's many values are only increased in the context of a changing climate, where their contribution to ecological and economic resilience becomes critical. Healthy ecosystems and a full complement of biodiversity can provide important buffers against the worst impacts of climate change. Their maintenance therefore has a potentially critical role to play in the climate change adaptation strategy of a still heavily forested area like Borneo. HoB forests also help to mitigate the impacts of climate change through carbon storage and sequestration.

Interdependence between nature and the economy

Local people living within the HoB depend on a broad range of services provided by the area's natural capital. For indigenous Dayak communities, over one million of whom live within the HoB, the area has provided a multitude of forest and freshwater resources over many thousands of years. Villagers living in the HoB use areas adjacent to their villages for mixed fruit orchards, agro-forestry and swidden agriculture. Further afield, they collect fuel wood and non-timber forest products, including honey, nuts, wildlife meat, song birds and a resinous wood known as 'gaharu'. Finally, freshwater fisheries provide a key source of protein for these communities.



Dependence and impacts of sectors on natural capital

More modern sectors of Borneo's economy, both within and outside of the HoB, depend heavily on ecosystem goods and services produced by the area as inputs into their production processes. Industries like liquefied natural gas (LNG) in Brunei require large quantities of water for processing, most of which originates from the HoB. Hydroelectric power plants in Sarawak benefit from retained sediments and water supplied by HoB's natural ecosystems. Sustainable production of palm oil requires healthy ecosystems and associated ecosystem services, including hydrological and decomposition services and nutrient cycling. Many mining companies in the HoB rely on river-based transport to deliver their output to market; they depend on forests' sediment retention and erosion control functions to avoid costly dredging or even temporary shutdown. Mining also benefits from the capacity of ecosystems to detoxify pollutants. Due to these ecosystem services—as well as others like water buffers, water purification, flood prevention, pest control and climate regulation—HoB ecosystems make crucial contributions to underlying sectoral productivity.

Interdependence between one sector (forestry) and HoB's natural capital

Natural capital on which forestry sector depends	Impacts of unsustainable forestry practices on natural capital	Impacts of declining natural capital on the forestry sector
• Timber supply • Hydrological services • Soil structure • Decomposition services of organic matter • Nutrient cycling	• Reduced long-term timber supply for short-term gains; • Degraded watershed functions (soil erosion, groundwater recharge, and river sedimentation); • Biodiversity loss; • Carbon emissions.	• Timber supply will not support long term sustainable business operations; • Loss of watershed regulation services can impact accessibility, and negatively impact other sectors in the landscape.

Impacts and costs of lost ecosystem services

Economic activities are having significant impacts on the HoB's natural capital and are thereby eroding its capacity to sustainably provide many ecosystem goods and services. 'Business-as-usual' economic practices, based on unsustainable use of natural resources, are having negative impacts on ecosystems, biodiversity and on the quality of individuals' health and livelihoods, not least among forest-dependent communities. Climate change is having further impacts, including sea level rise, risk of floods and fires and changes in the duration and intensity of wet and dry seasons. Together these impacts are feeding back to the sectors themselves—causing a parallel erosion of their long-term economic prospects and viability. The current economy not only undervalues natural capital but is neither inclusive nor sufficiently equitable. Growth in its current form appears to be unsustainable both for the island's ecosystems and species—which are facing severe pressures—as well as for its people—many of whom, despite rapid increases in GDP, continue to suffer from high levels of unemployment and poverty.

The impacts generated by current practices rarely respect sectoral boundaries and are imposing widespread external costs—or 'externalities'—on other economic sectors and on society as a whole. Some industries are now paying for services, such as water treatment or dredging, that a well-managed and functioning ecosystem would provide for free or at a lower cost. Under business as usual, a wide and increasing range of economic costs is being imposed on society by the unsustainable use of natural resources. Examples are shown on the following page.

In the current economy a wide and increasing range of economic costs is being imposed on society by unsustainable use of natural resources.

REDUCTION IN WATERSHED SERVICES

The HoB provides water supply, soil erosion control, and water purification to 29 river basins supporting households and economic sectors over an area of 54 million ha, or more than 70 per cent of Borneo, for the benefit of over 11 million people. The HoB thus supplies water to an area almost two and a half times its size. The loss of forests in its upstream ecosystems is impacting the economy and livelihoods far downstream and well outside of the HoB itself. Water shortages are imposing high costs on local communities, private businesses and on the authorities responsible for household water supply.

DECREASED WATER SUPPLY AND SALTWATER INTRUSION IMPACTS ON WATER SECURITY

Declining seasonal flows in West Kalimantan's rivers result in increased saltwater intrusion, with significant impacts on drinking water quality. Several water utilities have been forced to ration water during the dry season. To address this, companies must either find alternative sources of water or create reservoirs for freshwater storage. For the three main river basins of Kalimantan, the cost of building water storage reservoirs is estimated at US$10 million. To increase the capacity of water distribution in the dry season, the city of Pontianak in West Kalimantan is constructing a second pipeline to extract water from further upstream at an additional cost of over US$10 million. An additional US$2 million/year, exceeding US$2.5 million/year in extreme dry periods, is needed to pump drinking water. People who are not connected to a water distribution network face price increases of 50 per cent when obtaining clean water from vendors. In the dry season, this could lead to additional costs of US$30 per month per family, or about 30 per cent of their average monthly expenses.

WATER QUALITY IMPACTS

Expanding palm oil plantations pollute water sources through the excessive or improper use of fertilizers, pesticides and discharges of palm oil mill effluent (POME). The impact of such pollution on water quality is most severe during the rainy season.

IMPACTS OF FLOODING ON LIVES AND INFRASTRUCTURE

Flooding has become commonplace in Samarinda, along the Mahakam River, East Kalimantan, since coal mining and deforestation began upstream. Major floods in 2008-2009 affected families and disrupted the economy, transportation, employment and livelihoods. The total cost of these floods was estimated at US$9 million, while the cost of flood prevention is far greater than the town's income from coal. US$7 million has already been spent to construct a flood polder and local government has elaborated a flood mitigation plan that would cost another US$350 million.

IMPACTS OF INCREASED SILT LOAD ON RIVER TRANSPORT

Transport capacity—rather than production capacity—is the primary factor limiting the output of coal mining companies in Central and South Kalimantan. Barges are currently the least expensive means of transport in Kalimantan. However, high levels of sedimentation have, in the last 14 years, limited river transportation in the Barito River some 40 per cent of the year. Yearly dredging costs in the port of Banjarmasin, where 30 per cent of sediments are from the Barito River, are US$11 million. Losses of US$100 million/year are estimated for companies along the upper reaches of Barito River alone, due to limited transport capacity.

FIRE AND HAZE DISRUPTS ECONOMIES

In the 1997-1998 forest fires, total damages directly resulting from haze due to forest clearance and burning were US$1,012 million for Indonesia, US$310 million for Malaysia and US$104 million for Singapore. In West Kalimantan, as a consequence of the forest fires in 1997, loss of production of wild bee honey was estimated at US$67,000 to 84,000 per group of gatherers (10-12 people).

Is the economy at the service of people and ready for climate change?

Envisioning a green economy for people's well-being

Worldwide, as evidence of ecological damage and economic costs has mounted, interest in identifying alternatives to 'business-as-usual' has also increased. A 'green economy' can be seen as a new economic paradigm, driving growth of income and jobs, while reducing environmental risks and scarcities—in short, delivering sustainable development. Such an economy would sharply reduce or even reverse environmental damage, while also mitigating climate change and aiding adaptation. A green economy is an alternative economy, based on acknowledgement of the value of nature for people and incorporation of natural capital into economic policy and private sector decision making.

The concept of a green economy has developed largely in response to the need for low-carbon development strategies. However, in addition to being dramatically less carbon intensive, a green economy, particularly in forested nations such as Brunei, Indonesia and Malaysia, must fully value natural capital as an engine of sustainable development.

The following are among the main distinguishing factors between an economy that fully values natural capital—a green economy—and business as usual:

- It would increase human well-being and social equity while significantly reducing environmental risks and ecological scarcities.
- It would deliver inclusive growth while sustaining natural capital to provide for food, water, climate, soils and resource security.
- It would deliver on development priorities of local and national governments for the benefit of society, particularly its most impoverished segments.
- It would secure natural stocks for future use, enhance the provision of goods for revenue generation opportunities and avoid costs associated with damaged ecosystem services.

Implementing a green economy requires accounting for the contribution of nature to GDP and rethinking capital allocations, incentives, markets and development indicators. What would it cost to shift the path of development from its current, unsustainable trajectory onto a more sustainable, green economy pathway? What would be the impacts on economic growth, jobs and other economic and social outcomes? Can societies afford to put in place a green economy? Can they afford not to? Determining the answers is an essential step in gathering political will and consensus for what will inevitably be a challenging shift in economic direction and priorities.

Modeling the Green Economy I: the approach

Economic and environmental modeling provides a practical way to examine the likely costs, benefits and overall implications of a green economy approach. A first attempt to do so has been made for Kalimantan, which covers approximately 72 per cent of the HoB. The inclusion of Brunei and Sarawak and Sabah was not possible because important base datasets were not available for the whole of Borneo.

The approach compared, and estimated various differences between, two very different future paths, or scenarios. The first, known as the 'Business-as-Usual (BAU)' scenario, was derived from a set of land cover and land use datasets that identified the areas and locations of permits for forestry, palm oil and mining development. Under this scenario, developments under these permits are all implemented and sustainable practices are not commonplace.

Under the 'Green Economy (GE)' scenario, significant changes are implemented: palm oil development only takes place in already degraded areas; certified palm oil and timber increase; idle forestry land is protected and/or restored; applications of fertilizers and pesticides are reduced; mining practices are aligned with international best practices; energy efficiency and investments in renewable energy are prioritized; biodiversity-based industries are expanded, and; innovative business models to build local economies are in place.

Spatial scenarios for the Green Economy and Business-as-Usual scenarios were developed using the IDRISI Land Change Modeler (LCM), along with other GIS analyses. The scenarios represented inputs used to assess the gains or losses of ecosystem services using the Integrated Valuation of Ecosystem System Services and Tradeoffs (InVEST) tools. A dynamic simulation tool for development planning, based on Threshold 21, was used to create a more integrated nature-economy analysis.

A Green Economy Vision

Theme	Green Economy (GE)
Spatial planning	Coherent land use plans are prepared including the creation of a category for degraded land, expanding community forests and implementation of watershed protection.
Protected areas	Natural habitats are protected, with improved connectivity among protected areas.
Forestry	Reduced impact logging, international certification of sustainable forest management, plantations are limited to highly degraded or deforested areas that are not high conservation value forests (HCVF). Concession management is improved. Inactive forestry land is protected to reduce degradation. Forest restoration concessions are implemented within natural forest areas following logging.
Palm oil plantation	Oil palm plantations do not expand in any area of natural forest. Land swaps for permits granted within natural forest, to ensure expansion on degraded land only. The Roundtable for Sustainable Palm Oil (RSPO) ensures that management practices are improved, including improved fertilizer and pesticide application management.
Mining	Mining follows international good practice guidelines, with improved waste management treatment reducing impacts on air and water quality.
Agriculture	Sustainable agriculture practices maintain and restore soil quality, use of chemical fertilizers is reduced and larger biodiversity gene bank provides wild varieties that may be hybridized to ensure greater resilience to pest and diseases.
Energy	Increased energy efficiency reduces domestic consumption (especially of fossil fuels), renewable energy use expands and costs and impacts of fossil fuel consumption are reduced. Investments in non-hydro renewable energy power plants are implemented to decentralize power generation and to reduce consumption of coal for electricity supply and lower GHG emissions.
Biodiversity-based enterprises	Sustainable biodiversity products from legal community forests (NTFP and agro-forestry), bioprospecting and biotechnology supports soil quality, minimizes erosion and sedimentation and secures forest carbon by reducing pressure to convert forests.
Innovative green sectors	New business models build local economies, e.g. using 'waste products' from waste produced by current HoB industries.

The reliability of the modeling work was greatly enhanced by its use of a participatory approach in developing appropriate development scenarios, defining drivers and cause and effect relations, and collating data input into models. However, given that this report compares two simplified scenarios, the analysis may not include all the likely land use changes in the area; some of the omitted land uses could have significant impacts on ecosystems and biodiversity. With the methods chosen, a representative selection of nature's goods and services has been valued for which data are available. Other financially measurable goods and services exist, but in the short time-frame of this assessment, not all have been assessed. The modeling work made efforts to reduce the risk of double counting economic values and to address the challenge of appreciating fully the multiple roles of ecosystem services.

Modeling the Green Economy II: results of the scenario analysis

According to the results of the modeling work, an alternative future—one where the value of natural capital is fully recognized and appropriate investments are made in it—is feasible. Among the key results of the GE scenario, as compared with the BAU scenario, are reduced poverty, increased growth, more balanced development of local economies and increased support for climate change mitigation and adaptation. The assessment further finds that investing in natural capital will:

- decrease future costs to businesses, households and government;
- increase future revenue from biodiversity-based and green industries;
- raise crop yields and lower domestic energy consumption, and;
- support a transformation to a more just and equitable economy.

Main results of the scenario analysis

A green economy results in the protection of ecosystem services benefiting Borneo's economies and society, as well as global stakeholders. The modeling work indicates that a GE scenario benefits all. It not only secures net biophysical benefits from multiple ecosystem services important to society, but it also secures future revenue from improved natural capital and land management. The transition within a social cost-benefit framework suggests that the benefits outweigh the costs.

In the GE scenario:

- GDP growth is up to 0.2 per cent per year higher than in the BAU scenario. Gains steadily increase under the GE scenario, while in the BAU scenario the rate of growth in GDP slows down more quickly in the medium and longer term.
- Rural poverty is reduced, with a 5 per cent higher per capita rural income than in the BAU scenario.
- Employment rates are 30 per cent higher on average than in the BAU scenario.
- GHG emission intensity is 30 per cent lower than in the BAU scenario.
- Progress in building a biodiversity-based economy and the expansion of new green sectors contribute positively to the above economic indicators.

In the BAU scenario, by 2020 the environmental costs of economic growth are estimated to outweigh revenues from natural capital. In a GE scenario, an investment of 0.6 per cent of GDP per year is necessary to ensure economic growth and environmental quality beyond 2020. Investment needs decline over time as progress is made.

Growth under the GE scenario was assessed based on a conventional and a green calculation for GDP. Measured according to conventional GDP, GE investments will generate US$1.7 for each $1.00 invested by 2030. The break-even point (considering all investments) is achieved by 2024. Measured according to green GDP—which includes the contribution of natural stocks and welfare and takes into account the effects of production practices and GDP on natural capital—GE investments by 2030 will generate US$4.2 for each $1.00 invested.

Specific findings include:

The BAU scenario for forest cover projects a loss of 3.2 million ha of primary and secondary forest cover between 2009 and 2020, primarily due to palm oil expansion, mining and unsustainable forestry practices. Under the GE projection, the loss of forest cover is reduced to 0.1 million ha. The difference in forest cover under the two contrasting scenarios represents the foundation upon which modeling results—including quantified gains / losses of ecosystem services and the value of natural capital in the analysis—are built.

The Heart of Borneo provides water to 70 per cent of the population of Kalimantan. The Heart of Borneo contributes as much as 60 per cent, 40 per cent and 55 per cent of annual water supply to the Kapuas, Kapuas-Barito, and Mahakam river basins, respectively.

Water quality is impacted by large scale palm oil development. Palm oil plantations affect water quality through increased nitrogen export from extensive fertilizer use, particularly in the Kapuas-Barito basin. Under the BAU scenario, additional application of fertilizer and loss of filtering riparian forests along waterways could increase nutrient export tenfold compared to 2009 in the three basins assessed. The largest impacts occur in the Kapuas basin, due to major expansion of palm oil plantations, affecting up to 11 Indonesian local water utilities.

The GE scenario results in higher carbon stocks compared with BAU—curbing the projected reduction in carbon stocks. Based on the projected forest cover loss of 3.2 million ha, the difference in carbon stocks between the BAU and GE scenarios is 1.2 billion tonnes of CO_2e, of which 23 per cent is contributed by land use change in the HoB. Assuming a carbon price in the range of US$2/ton and US$15/ton, the total value of the projected increase in carbon stock under the GE scenario would be between US$2.4 billion and US$18 billion.

GE scenario results in more effective ecological infrastructure, with a lower probability of floods, erosion and sedimentation of waterways with expected increases in average precipitation and reduced deforestation. For example:

- The BAU scenario presents a worsening trend of sedimentation, which will require additional infrastructure investments (for transport and energy in the specific cases analyzed), both for additional maintenance and for construction to make up for the ecological infrastructure lost (e.g. reduced river use).
- The GE scenario has positive impacts on watersheds. Sediment retention capacity will increase due to reduced run-off and landslides and avoided siltation. Floods cause a damage of more than US$12 million/year to households in the three major river basins of Kalimantan. Apart from seasonal events of floods–which may be mitigated but cannot be entirely avoided–the GE scenario greatly reduces the damage projected under BAU, avoiding related costs to households and transport infrastructure, and extending the average lifetime of roads.

GE scenario with a complete shift to Reduced Impact Logging (RIL) secures carbon, reduces erosion and river sedimentation.

Carbon: Approximately 115 million additional tonnes of carbon (tC) could be stored by implementing RIL in 158 timber concessions. With improved timber management practices, about 19 more tonnes of carbon (tC) per hectare could be stored as compared with existing concession management practices. Based on the social cost (i.e., the damage to global society) of these emissions, the social value of storing that carbon would be close to US$4 billion. The largest timber concession alone could provide a social value of over US$250 million by implementing reduced impact logging (RIL).

Sediment retention: Improved timber management In the Mahakam river basin could increase sediment retention by 2020 by close to 900,000 tonnes across all 49 timber concessions in the basin, with a mean avoided erosion of around 37 tonnes of soil per hectare annually.

Mainstreaming natural capital into planning, policy and economic decision making

The modeling results and broader analysis presented here are designed to help lay a foundation for discussions regarding investments, policies and incentives to be put in place by national and local governments. The type of policy package put in place to achieve a green economy will be critical in determining the kinds of investments that will be made and the incidence of costs and benefits, i.e., who will pay and who will benefit.

The HoB governments have already begun to take coordinated action to recognize and act upon the value of natural capital, the 'Heart of Borneo Initiative' itself being the prime example. All three countries have established governance structures to help fulfill their obligations under the HoB Declaration and have developed Strategic Plans of Action. Ongoing implementation of the HoB Declaration is demonstrating that three countries sharing a common vision are able to move beyond this vision into action.

These bold steps—undertaken based on an enhanced recognition of the importance of HoB's forests, freshwater and biodiversity—represent the beginning of a journey towards an economy that respects nature and is at the service of people. Sectoral policies such as land-use and emission reduction policies in Kalimantan, feed-in-tariffs for renewable energy (to remove the barriers to entry to the market) in Malaysia, and a public private partnership for biodiversity conservation in Brunei provide evidence that progress towards a green economy has already begun.

Remaining challenges include aligning and harmonizing relevant economic and development plans with the HoB Initiative. While sectoral policies are beginning to emerge in each of the HoB countries, an integrated green economy approach across sectors is necessary to accelerate the transition to an economy that values natural capital. To date, economic plans have been developed in parallel and independently from one other; as a result, a consistent and holistic green economy approach, one that mainstreams the ecosystem value of the HoB landscape into policy and economic decision making, is not yet the norm.

A green economy policy package

The scenario analysis indicates that, in the long term, a green economy has environmental, social and economic advantages. However, for a green economy to develop, a shared green vision and initiatives by civil society, businesses, consumers, government, etc., are required. These efforts can bring about an economic transformation, provided an enabling economic environment is established by HoB governments. It is up to governments to give meaning, content and, finally, concrete substance to this vision.

The most essential enabler of a transition to a green economy is therefore a structural one: the economic infrastructure. What is needed is a transformation in terms of policy frameworks and legislation, institutions and regulations. Reducing and eventually eliminating subsidies that encourage destruction of natural capital is an essential part of this process. A carefully designed and synergetic set of cross-sectoral policy changes at national and local level can provide incentives for environmentally sustainable economic activity and penalize actions that lead to environmental degradation. An integrated and coherent policy package of this kind can result in behavioural change among concerned stakeholders.

Based on these policies, economic instruments can be designed and implemented to incentivize biodiversity-based industries and other green sectors to secure important natural stocks. Incentives can be used to promote the use of heavily degraded land for palm oil development, while less degraded areas can be targeted for restoration or for expansion of protected areas. At the same time, conversion and poor management of healthy forest ecosystems can be discouraged.

Economic instruments are less effective when implemented in isolation; a green policy package ensures synergies and an appropriate distribution of costs and benefits. Ministries of finance, development and economic affairs, along with environment and sector-specific agencies, play key roles in facilitating this green economy approach. International finance—including REDD+ finance—and domestic public funds can and should be used to jumpstart the process.

Effective economic instruments, alongside strong law enforcement and clear land tenure, will create a 'green' investment climate—one that encourages the private sector to adopt sustainable practices and rewards sub-national governments and communities for good stewardship. Most costs can be repaid by a more sustainable and inclusive local economy. Local biodiversity-based and innovative green sectors can cover their start-up costs and conventional private sector actors will reap the benefits of 'going green'.

Economic instruments to sustain natural capital

Type of instrument	Description
Performance-based regional incentive mechanism	Increased budget allocation to sub-national governments based on performance measured by natural capital indicators.
Regulated Payment for Ecosystem Services (PES) at scale	Payments made by private sector and households at the level of a river basin channeled through a funding mechanism.
Biodiversity offsets (Biobanking)	Compensation payments for a projects' significant residual impact on biodiversity. Sectors will undertake biodiversity offsets to ensure "no net loss" in the context of their operations, and preferably a net gain.
Government investment programmes	Government injects capital into the development of biodiversity-based enterprises, innovative green sectors and support activities such as reforestation and expansion of Protected Areas. Other interventions may include support for energy efficiency.
Financial institutions	Low-interest financing and favorable loan arrangements to green business; tax breaks on investments; risk sharing (e.g. a Multilateral Development Bank could share the risk of lending with a local bank or provide a first-loss facility on an investment).
International carbon market finance	Payments to stakeholders who reduce their carbon emissions from forest areas or conserve carbon stocks, through activities such as sustainable forest management, reduced impact logging, forest restoration and conservation, etc.
Incentives to certified logging concessions	Tax deduction, financial incentive or other forms of economic incentives to private sector, for example: • a reduced amount of annual checks (like waiving heavy equipment license); • given allowance to export a percentage of their products directly to the export market; • given a priority for new permits to expand areas and new concessions; • paying fees in accord to actual harvesting volume and not upfront.
Incentives to certified palm oil concessions on existing degraded land	Tax deduction, financial incentive or other forms of economic incentives to private sector: • release from land tax; • providing fertilizer subsidies to plasma farmers; • issue palm oil permit only for degraded land; • increased tariff on timber from the converted forest land to oil palm plantation; • increased income tax for palm oil plantation in forest area.
Incentives for responsible mining	Taxes or charges on pollutants and wastes or other forms of economic incentives
Market instruments	Responsible consumers' and corporations' demand for sustainable products has set in motion a voluntary process through which an independent third party issues a certificate guaranteeing that management of a forest/plantation is carried out according to established criteria and standards.

Green economy solutions and critical steps

While governments can set the stage, a green economy cannot be delivered by governments alone. A wide range of stakeholders have roles to play in realizing this vision.

Throughout 2011 and early 2012, stakeholder consultations and workshops were held to explore the potential for, and local views on, a green economy in Borneo and HoB's potential role. These participatory processes have identified potential on-the-ground green economy solutions which can help to guide government, business and other stakeholders towards an economy that values natural capital, reduces poverty and builds local economies. Many of these solutions are already starting to emerge, but not yet at scale.

Five types of sector-specific solutions appear most promising:

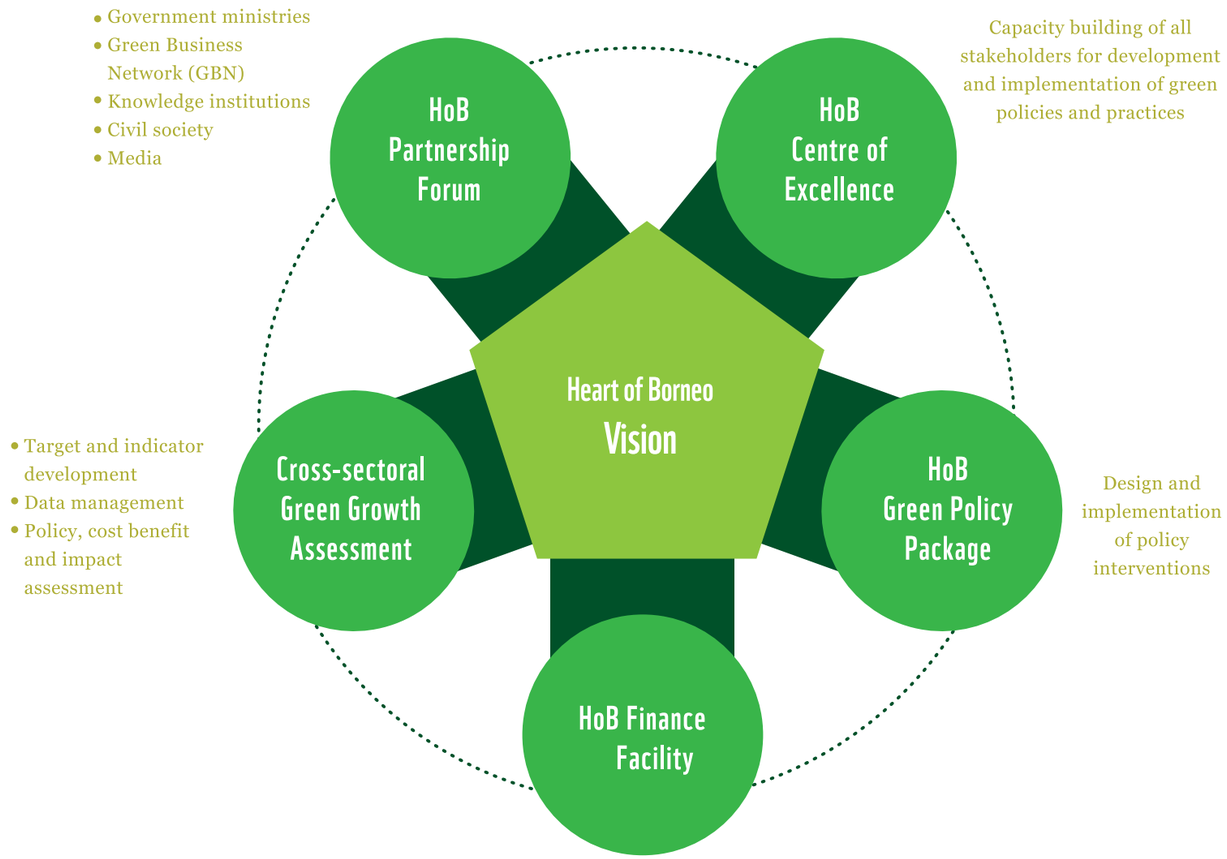
- Biodiversity-based enterprises run by community-managed areas, where communities are directly involved in marketing biodiversity-based (including agroforestry) products;
- Transboundary ecotourism, an integrated strategy for which would enhance biodiversity, local livelihoods and help to sustain Dayak culture;
- Future biodiversity-based businesses, which include market-based mechanisms that recognize natural capital as an asset. Examples include bio-banking, bioprospecting and ecosystem restoration as a commercial service;
- Innovative green sectors, which include green energy such as micro-hydro power and technologies which turn waste into raw materials for generating energy or other useful products (e.g. processing of palm oil effluent to energy);
- Greening large-scale, high-impact sectors, including logging, palm oil cultivation and mining requires a range of investments to enhance sustainability.

Besides sector-specific solutions, several essential cross-cutting solutions require a collaborative approach among various sectors:

- Participatory ecosystem-based spatial planning, a tool for landscape management uses ecosystem boundaries as the delineating factor rather than district, state or other administrative boundaries;
- Integrated watershed management, an approach which promotes the coordinated development and management of water, land and related resources in a watershed in order to maximize economic and social welfare and equity without compromising the sustainability of vital ecosystems and the environment;
- Expanding protected areas networks and improving connectivity helps to preserve their ecological integrity for enhanced flow of ecosystem services while facilitating gene flow and building resilience in a changing climate.

Finally, a set of measurable indicators and targets would help to demonstrate whether and to what extent specific initiatives were contributing to green economic development in the three countries. Indicators and targets would highlight the potential for the HoB Initiative to contribute to the achievement of national government goals on GHG emissions reduction, poverty reduction, water management and energy and food security. Not only indicators of environmental change but also economic indicators need to be included.

A number of critical next steps would accelerate the development of transformational policies and the implementation of the above green economy solutions. Forming a formal partnership led by HoB governments is the first of five critical steps. This will form the basis for further capacity building, data collection, policy research and a gateway to finance.



Critical steps to deliver HoB's vision

Conclusion

The critical social and economic role of HoB ecosystems is rapidly becoming more widely understood. Ongoing efforts are beginning to demonstrate that a green economy approach to achieving the HoB governments' vision of conservation and sustainable development will lead to more inclusive economic planning, management and accounting within the economies of Brunei, Kalimantan, Sabah and Sarawak.

The present report is based primarily on stakeholder dialogues and economic and environmental modeling. Its purpose is not to provide detailed, technical guideline for policy design. Instead, it aims to introduce stakeholders to a set of tools and methodologies that can support policy discussions regarding investments, policies and incentives and on-the-ground, cross-sectoral implementation. Nevertheless, work done to date has provided fairly strong evidence that an alternative economic approach is feasible and that the HoB landscape and its natural capital are worthy of substantially higher levels of investment.

HoB Governments made a bold commitment in 2007 to dedicate a significant portion of Borneo as the 'Heart of Borneo'. In so doing, these governments embarked on a road towards a green economy well before many others did; their vision, together with that of a wide range of partners, is worth applauding. Yet many of the most important steps—those needed to ensure the emergence of a truly green economy in the HoB—remain to be taken. By transforming the vision described in the Heart of Borneo Declaration into reality, Governments and their partners can create Southeast Asia's foremost green economy.

PART I:
INTRODUCTION AND STUDY OVERVIEW

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This report, alongside the synthesis report and website www.hobgreeneconomy.org, have been developed in support of the Heart of Borneo (HoB) governments as they implement their HoB transboundary initiative.

A priority challenge facing the three governments—one which is highlighted in a recent three-country publication, *Financing the HoB: A Partnership Approach to Economic Sustainability*[1], is the need to harmonize HoB plans and current development plans in order to reflect economic, social, climate, biodiversity and poverty reduction objectives. A green economy approach will help deliver the three-country HoB Declaration by promoting people's welfare through conservation and sustainable development.

With this in mind, a group of HoB supporters—including WWF, Knowledge SRL, Millennium Institute, Hatfield and Witteveen+Bos, with support from the European Space Agency and the WWF network—have worked together to develop a snapshot of the many values provided by the Heart of Borneo ecosystems and biodiversity to society and to the economy. The analysis includes a review of the impacts and costs of lost ecosystem services in the current economy; an effort to model a future in which the value of nature is mainstreamed within economic planning; and a vision of an economy which invests in nature and is at the service of people, bringing benefits to all stakeholders and to nature itself.

The report draws together experience and lessons gained from field work in the HoB and builds on real on-the-ground examples, as well as on an economic and environmental modeling work. It is based on extensive stakeholder engagements undertaken between 2010-2012 at national and sub-national levels involving governments, the private sector and civil society.

Among other objectives, the report aims to help demystify the term 'green economy'. A number of green growth plans have been developed without fully recognizing the value of nature to the economy and society. Unfortunately, a common interpretation of a green economy mostly relates to production practices: greater resource efficiency, waste and emission reductions. It does not tackle the core issue of why economies need to be more resource efficient and environmentally friendly.

Public and private decision makers typically do not account for the value added by nature in their evaluation of economic policies and investment plans. This is partly because conventional economic and market indicators do not reveal the benefits provided by nature nor the economic costs associated with resource depletion and the loss of ecosystem services. Ignoring the value of nature results in market failure, policy failure and misallocation of capital, leading to further resource depletion and environmental degradation in an on-going and vicious cycle.

Maintaining the values provided by nature is essential to sustaining and growing a lasting economy for the benefit of all stakeholders. The core challenge in applying a green economy approach is therefore finding ways to sustain nature while simultaneously promoting sustainable economic development.

This report highlights the significant contribution of nature in sustaining a prosperous and inclusive economy. The emphasis is on the value of nature and its fundamental role in an economy and for people's well-being, particularly in forested nations.

Part I:

Introduction and Study Overview

FIGURES

BOXES

1.1 The Heart of Borneo Initiative

Comprising approximately 30 per cent of the island of Borneo's land area, the Heart of Borneo (HoB) covers more than 22 million hectares of tropical rainforest across three countries: Brunei Darussalam, Indonesia (Kalimantan) and Malaysia (Sabah and Sarawak). It is the largest transboundary tropical forest expanse remaining in Southeast Asia. Home to an astounding six per cent of the world's biodiversity, from the orangutan to the world's largest flower, and containing the headwaters for 14 of Borneo's 20 major rivers, the HoB is one of the planet's richest treasure troves. More than 500 new species, or about three per month, have been discovered within the HoB since 1995. More than one million people, the majority of whom are of Dayak origin, live within the HoB and directly depend on its forests for their livelihoods, food, income, water and culture.

While a large portion of Borneo's lowland areas has been converted from forests to other land uses, much of the HoB remains relatively intact. However, the threat of deforestation and forest degradation is an ongoing one. Most threats to natural forest[2] are linked to Borneo's continued economic dependence upon extraction of primary resources. Palm oil plantations and mining have expanded rapidly in recent years. These sectors, along with pulp and paper and timber, have been slow to adopt sustainable management practices or environmental impact mitigation measures.

Population growth, demand for agricultural land and the effects of climate change are also having significant impacts on the ability of natural ecosystems to support biodiversity and to continue to supply various ecosystem services to people across the island of Borneo—including many living beyond the boundaries of the HoB itself. Ecosystem services are the benefits that people obtain from the dynamic interactions that occur within functioning ecosystems, between plant, animal, and micro-organism communities and the non-living environment. Humanity is fundamentally dependent on the flow of these ecosystem services[3].

The HoB's ecosystems also play a critical role related to climate change. First, HoB forest ecosystems have a globally significant role in storing, or sequestering, carbon. In addition, they help to create resilience in the context of a changing climate. Nevertheless, climate change is already leading to more severe dry seasons in some parts of Borneo resulting in seasonal water stress[4]; combined with higher rainfall overall, this is leading to more runoff and flood events. Biodiversity conservation and sustainable forest management in the HoB are crucial to maintaining the flow of these ecosystem services and to supporting the economy for people's well-being.

The Heart of Borneo (HoB) Initiative is a transboundary collaboration among the governments of Brunei, Indonesia and Malaysia to enable conservation and sustainable development that improves the welfare of those living on the island while minimizing deforestation, forest degradation and the associated loss of biodiversity and ecosystem services. Under this Initiative, the three countries involved have committed 355,000 hectares, 16.8 million hectares and six million hectares respectively to be included in the HoB[5]. The commitments of the three HoB governments are contained in the Heart of Borneo Declaration.

> "With one conservation vision and with a view to promote people's welfare, we will cooperate in ensuring the effective management of forest resources and conservation of a network of protected areas, productive forests and other sustainable land-uses within an area which the three respective countries will designate as the 'Heart of Borneo'."
>
> *- Heart of Borneo Declaration (2007)*

The Heart of Borneo Initiative is a prime example of a coordinated, transboundary approach to conservation and sustainable development.

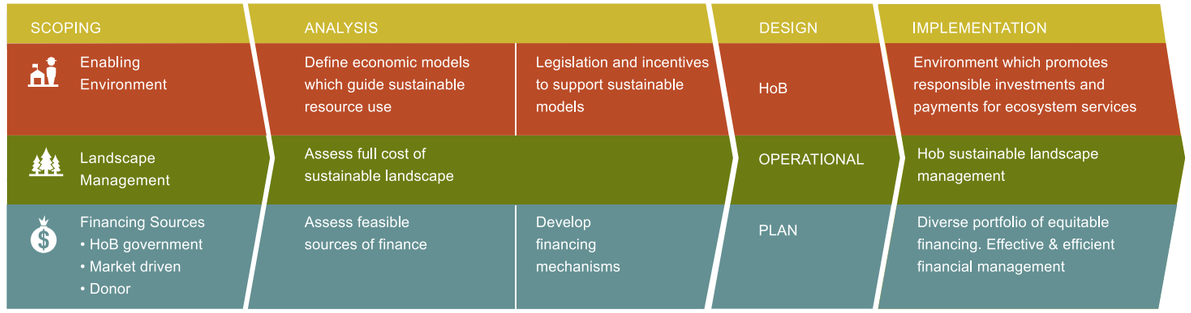

Figure 1.1: Approach from *Financing the HoB – A Partnership Approach to Economic Sustainability* (2010), a three-country publication

In 2005, the HoB Initiative was formally endorsed by the ASEAN Heads of Government and adopted as a Flagship Project of the Brunei-Indonesia-Malaysia-Philippines East ASEAN Growth Area (BIMP-EAGA).

All three countries have established governance structures to help fulfill their obligations under the HoB declaration: the HoB National Council in Brunei, HoB Working Groups in Indonesia and a National Expert Group and Steering Committees in Malaysia. The three governments have also jointly developed a trilateral Strategic Plan of Action and each country has developed an HoB-specific Strategic Plan of Action or Project Implementation Framework. These plans and frameworks embody the strategic approach being taken by each country in order to achieve the goals of the declaration.

Specific steps needed in order to mainstream the value of ecosystems in the HoB into policy and decision making and to use market mechanisms to drive green growth were laid out in *Financing the Heart of Borneo – A Partnership Approach to Economic Sustainability* (2010), a three-country publication. The report highlights priority actions needed in order to integrate the value of forests, biodiversity and healthy watersheds into national and local development plans, while optimizing economic returns to improve people's livelihoods and national economies. The approach is outlined in Figure 1.1 above.

When the three governments launched the above report at the UN Convention on Biodiversity in Nagoya (2010), they agreed to pursue the following next steps:

- Understand the value of forests, watersheds, biodiversity and potential for carbon emission reduction and distribution to beneficiaries;
- Assess how to optimize economic growth while maintaining HoB's natural capital and its contribution to climate change; and
- Estimate the costs and benefits associated with sustainable landscape management.

The present report is designed as a specific contribution towards completion of the above-mentioned steps.

The three governments are also actively developing strategies and policies for the HoB. For example, Indonesia has designated its HoB territory as a Strategic National Area (KSN) under government regulation PP 26 (2008) for its abundance in natural resources. The recent Presidential Regulation no. 3 (2012) formalizing Kalimantan's spatial plan makes specific mention of the designated HoB Strategic National Area, emphasizing the recognition of the area in the spatial planning process, while also confirming the designation of 45 per cent of Kalimantan for conservation of biodiversity. A presidential decree linked to an HoB-specific spatial plan (at a scale of 1:50,000) is currently under development to guide conservation and development efforts in the HoB. At the local level, the district government of Kutai Barat in Kalimantan is creating enabling conditions for a district-level REDD+ program. This includes spatial planning, governance, and stakeholder involvement to improve forest protection, utilize only degraded lands for palm oil expansion and secure community conservation areas for biodiversity, carbon and socio-cultural values.

In Malaysia, federal government allocations for Sabah and Sarawak for HoB implementation through the 10th Malaysia Plan have grown significantly. For its 2011-2012 rolling plan, Sabah has received MYR6 million for its HoB program, while Sarawak has received MYR3.5 million. Sabah's HoB program focuses on implementing a policy review to enhance institutional arrangements in the state to enable REDD+ process within the framework of a green economy to mainstream valuation of ecosystem services into economic development and land-use planning. The state has also developed—and received US$4.4 million in grant support from the Global Environment Facility (GEF) for—a $13.2 million project titled 'Biodiversity Conservation in a Multiple Use Landscape in Sabah'. In Sarawak, the focus has been on strengthening protected area management and bioprospecting efforts.

For its part, Brunei has elaborated 36 specific interventions including greatly increasing the area of its protected forests, ceasing to log natural forests entirely and strengthening institutional and human capacities to support conservation and sustainable development in the HoB.

Actions in the HoB have already begun to demonstrate tangible results, based on successful application of a new way of thinking, which are advancing the economy and helping to assure the long-term future of natural assets that underpin it. However, to fully realize the HoB Declaration and to make further progress in their transition to a green economy, Brunei, Indonesia and Malaysia will need to invest in the ecosystems and biodiversity of the HoB and to incorporate their essential contributions to the economy within national and local economic and development plans.

Box 1.1: Transboundary and inter-agency collaboration

Enhanced transboundary collaboration, as well as inter-agency co-operation within each of the HoB member countries, are essential to the success of the HoB Initiative. Fortunately, a number of steps have already been taken in this area.

In Brunei, the HoB National Council is led by the Ministry of Industry and Primary Resources (MIPR), with various government agencies participating in the Council. In addition to the HoB National Council, a Brunei HoB Center (HoB Center) has been proposed as a lead institution to facilitate the implementation of HoB programmes.

In Indonesia, there is support from 11 ministries constituting the Indonesian government's HoB National Working Group; this umbrella organization includes operational units consisting of three provincial working groups and 10 district working groups. The Working Group is chaired by the Coordinating Ministry of Economic Affairs.

Malaysia's HoB National Steering Committee is chaired by the Ministry of Natural Resources and Environment at federal level. Sabah and Sarawak each have their own inter-agency steering committee.

DECLARATION ON THE HEART OF BORNEO INITIATIVE
Three Countries, One Conservation Vision

We, the Governments of Brunei Darussalam, Indonesia and Malaysia, recognizing the importance of the Island of Borneo as a life support system, hereby declare that:

- With one conservation vision and with a view to promote people's welfare, we will cooperate in ensuring the effective management of forest resources and conservation of a network of protected areas, productive forests and other sustainable land-uses within an area which the three respective countries will designate as the "Heart of Borneo (HoB)", thereby maintaining Bornean natural heritage for the benefit of present and future generations, with full respect to each country's sovereignty and territorial boundaries, and also without prejudice to the ongoing negotiations on land boundary demarcation.
- The HoB Initiative is a voluntary trans-boundary cooperation of the three countries combining the stakeholders' interests, based on local wisdom, acknowledgement of and respect for laws, regulations and policies in the respective countries and taking into consideration relevant multilateral environmental agreements, as well as existing regional and bilateral agreements / arrangements.
- We are willing to cooperate based on sustainable development principles through research and development, sustainable use, protection, education and training, fundraising, as well as other activities that are relevant to trans-boundary management, conservation and development within the areas of the HoB.

To support this Declaration, we, the three countries will prepare our respective project documents incorporating the strategic and operational plans, which will form the basis for the development of our road map towards realizing the vision of the HoB Initiative.

Done at Bali, Indonesia on the twelfth day of February, two thousand and seven in three original copies.

For the Government of His Majesty the Sultan and Yang Di-Pertuan of Brunei Darussalam	For the Government of the Republic of Indonesia	For the Government of Malaysia
H.E. Pehin Dato Dr. Awang Haji Ahmad bin Haji Jumat Minister of Industry and Primary Resources, Brunei Darussalam	**H.E. Mr. M. S. Kaban** Minister of Forestry, Republic of Indonesia	**H.E. Dato' Seri Azmi bin Khalid** Minister of Natural Resources and Environment, Malaysia

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1.2 Green Growth Assessment

Since late 2010, a group of HoB supporters—including WWF, Knowledge SRL, Millennium Institute, Hatfield Consultants and Witteveen + Bos—has been working together to support the HoB governments as they begin to tackle the priority steps agreed on in the *Financing the Heart of Borneo* report. The present report represents an important outcome of that collaboration. The report's methodology, particularly its emphasis on economic valuation of ecosystems and biodiversity, has been inspired in part by the Economics of Ecosystems and Biodiversity (TEEB)[6] effort. Whilst not part of the TEEB initiative per se, the report has certainly been influenced by the dissemination of the TEEB reports, as well as by the ongoing TEEB implementation efforts[7]. This chapter introduces some of the thinking underlying the report.

An obvious first question to ask is: what exactly is a green economy? UNEP's Green Economy Report (2011) defines a green economy as "…an economy that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities". This definition emphasizes reductions in carbon emissions and pollution, improvements in energy and resource efficiency, and minimal or no loss of biodiversity and ecosystem services. A green economy favors renewable energy and low carbon and environmentally-friendly economic development.

In the context of sustainable development and poverty eradication, a green economy should protect and enhance the natural resource base, increase resource efficiency, promote sustainable consumption and production patterns and involve low-carbon development.

The concept of a green economy is closely linked to the idea of "green growth". This depends on an extension of capital theory to include what may be termed "natural capital," which comprises the biosphere as a whole, including ecosystems and biodiversity and which is an indispensable enabler of economic growth and human well-being. A key aspect of a green economy is its emphasis on sustaining natural capital to secure green growth and long-term prosperity. The green economy concept thus calls for green growth within an economy that takes into account the importance of natural capital for society and results in improved human well-being and social equity because it invests in restoring, sustaining and enhancing that capital.

HoB's ecosystems and biodiversity are part of Earth's natural capital. Key elements of natural capital, in the case of the HoB, are natural resources such as forests, minerals, soil and water; ecosystem goods, such as timber and a range of biodiversity-based products; and ecosystem services such as water supply and carbon sequestration provided by those resources.

The report is intended to inform policy and decision makers concerning the economic necessity of investing in sustaining the HoB's natural capital through policies, regulations, incentives and on-the-ground solutions.

Box 1.2: Report objectives

(1) Showcase the many values of the HoB's ecosystems and biodiversity;
(2) Provide an innovative analysis that accounts for the contribution and value of these ecosystems and biodiversity, i.e., natural capital to the economy;
(3) Estimate the investment needed to transition to sustainable landscape management in the HoB, which would protect natural capital;
(4) Support further evaluation and policy formulation for the elaboration of coherent strategies to mainstream HoB Strategic Plans of Action[8] into national and local economic development plans.

While many may agree on the importance of investing in natural capital in principle, competing demands over the allocation of public funds mean that actual investments remain inadequate. The ability to make a business case for increased investment in HoB's natural capital is most significantly undermined by the ongoing under-valuation of natural forests.

Box 1.3: Critical questions

- How valuable are the natural ecosystems and associated services of the HoB to the economies of Brunei, Indonesia and Malaysia?
- Who profits from these ecosystem services?
- Who suffers from degradation or loss of ecosystem services?
- How can changes in regulations or incentives stimulate investment in sustaining forest ecosystems?
- What investments would be required to safeguard ecosystem services?
- Do the benefits of a given investment in sustaining ecosystems and biodiversity justify the costs?
- Does a given investment in sustaining ecosystems and biodiversity result in a more equitable distribution of benefits?
- Would investment in sustaining ecosystems and biodiversity support the reduction of poverty?
- Would investment in sustaining ecosystems and biodiversity benefit long-term economic growth?
- What are the likely short- and long-term impacts of climate change on HoB's natural ecosystems and services and how should these affect decisions regarding investments in natural capital?

The present report is therefore designed to inform policy- and decision-makers and underscore the economic necessity of investing in sustaining the HoB's natural capital through policies, regulations, incentives and solutions on the ground. With a clearer picture of the economic importance of natural capital—including the benefits for employment and economic growth, and in terms of more sustainable investment returns—public and private stakeholders should be more willing to invest in sustaining ecosystems and biodiversity.

As shown in Figure 1.2, the assessment presented in this report is based on a framework of five dimensions of green growth, with a focus on how the value of natural capital contributes to green growth. These dimensions include elements of classical economic growth, combined with values of ecosystems and equitable social development.

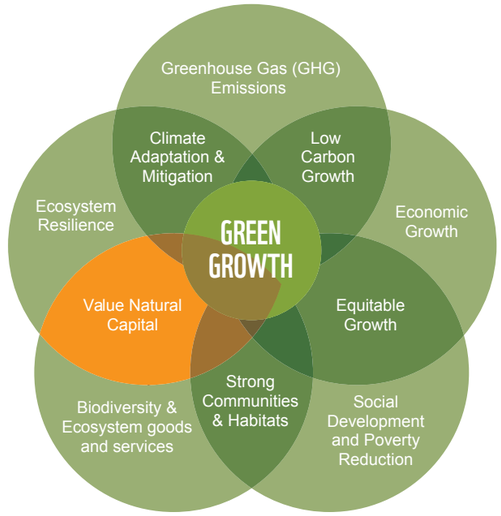

Figure 1.2: Five dimensions of green growth

The geographical focus of the study is the HoB landscape, which spreads across three countries, and mostly comprises mountainous forests forming the headwaters of major river basins that drain to each country's coastline. Many of HoB's most valuable ecosystem services, like water supply, prevention of soil erosion and flood control, provide benefits far beyond the area's boundaries. While the HoB covers an area the size of 22 million ha (close to 30 per cent of Borneo), its ecosystems support key economic sectors across

54 million ha (over 70 per cent) of the island, where over 11 million people live[10]. For this reason, the overall scope of the assessment extends beyond the boundaries of the HoB. The analysis focuses both on sectors currently most important to the respective economies and those of potential economic importance. Due to the challenge of acquiring consistent data across all three countries, the economic and environmental modeling is primarily based on data from Kalimantan. However, given that Kalimantan covers almost 70 per cent of the HoB and also given the similar characteristics of the ecosystems and the similar interactions with the areas surrounding the HoB, the findings may be considered broadly applicable to the entire HoB.

The report examines the often unrecognized environmental benefits arising from the HoB as well as the environmental costs associated with unsustainable landscape management leading to environmental degradation. Spatially-explicit development scenarios comprising a mosaic of land uses across the landscape are modeled in an innovative way, including simulations of alternative futures to show the important relationships among nature, economy and society, changes in land cover, ecosystem services and GDP, based on a range of variables. Two scenarios are presented and compared: a 'Business-as-Usual (BAU) scenario', which arises from a traditional approach to economic development and Gross Domestic Product (GDP) calculations, and a 'Green Economy (GE) scenario', in which natural capital is fully valued by all sectors that have a stake within the HoB landscape. BAU assumes the continuation of current business activities that damage or deplete natural capital and is characterized by a focus on short-term gains (< 10 years), externalization of impacts and their costs, and little or no recognition of the economic value of natural capital and associated goods and services. A green economy focuses on longer-term income (> 10 years) and internalizes most environmental impacts and costs, thereby avoiding the degradation of natural capital and ensuring the long-term flow of ecosystem goods and services. The economic and environmental modeling aims to provide policy makers with the tools and analysis needed to support more informed decision-making—particularly related to mainstreaming the value of HoB natural capital into economic decision-making processes.

To complete an assessment of natural capital for an area as large and diverse as the HoB is challenging. The assessment has been undertaken using data sets that are as complete, consistent, current and accurate as possible. Published datasets are used where possible and all third party data were reviewed by the study team to ensure their appropriateness. Land cover and land use are particularly important data sources to assess changes in biodiversity and ecosystem goods and services at a landscape scale. A variety of satellite remote sensing data have been sourced and used for this purpose. In some cases, data were not available for the entire island, an individual country or even a province or state. Partly as a result of these limitations in data availability and quality, there is moderate to high uncertainty in the outcomes of the modeling work. Nevertheless, the main purpose of the assessment is to inform the HoB governments along with other stakeholders in understanding some of the fundamental issues and trends related to economic development and natural capital. It is hoped that this analysis will stimulate more precise valuations of natural capital, more robust scenario modeling and wider public discussions and debates around a green economy in general and in HoB in particular. A related website (www.hobgreeneconomy.org), which was developed as part of this assessment, provides access to the data and to additional information on methods and tools.

The report is intended to inform policy and decision makers concerning the economic necessity of investing in sustaining the HoB's natural capital through policies, regulations, incentives and solutions on the ground. Following the present introduction, the report is broken down into four parts, which are outlined below.

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Part II

Part II describes the current HoB economy and its complex, interdependent relationship with HoB's ecosystems and biodiversity. It includes four chapters: Chapter 2.1 presents the theoretical and methodological framework for the report, including the concepts of natural capital, ecosystem goods and ecosystem services. The chapter describes an economy-nature disconnect, according to which conventional economic analysis has tended to overlook the extensive contributions of nature to economic activity. It also presents the impact pathways through which reliance on natural capital can affect the economy and vice versa.

Chapter 2.2 outlines some of the key, but often overlooked, environmental economic values of the HoB, including biodiversity, ecosystem resilience in a changing climate, water-related ecosystem services, social values, micro-climate regulation and carbon sequestration. This chapter does not attempt to estimate total economic value, presenting instead a qualitative picture of these important and non-monetized values.

Chapter 2.3 presents a sectoral overview of economy-nature interdependence. Seven sectors—timber supply, palm oil, mining, local forest-based enterprise, freshwater fisheries, hydropower and tourism—are described. The purpose here is twofold: first, to better understand the impacts of unsustainable practices within the sector on natural capital, and; second, to understand the feedback effect that declining natural capital is having on the sector.

In contrast to the qualitative approach employed in chapter 2.2, chapter 2.4 presents quantitative estimates of impacts and costs associated with lost ecosystem services. These are presented according to the service in question, i.e., costs due to changing water resource availability, water quality impacts, impacts of sedimentation, etc. While the figures presented here are of a partial and preliminary nature, they do indicate the actual and potential severity of economic impacts associated with declining HoB natural capital.

Part III

Part III presents an initial attempt to quantify the contribution of natural capital to the society and economy of Borneo. It describes, and presents the findings of, a modeling exercise aimed at generating preliminary estimates of the economic value of natural resource stocks, ecosystem goods and ecosystem services and estimating how their conservation could contribute to continuing and inclusive economic prosperity. It begins with a conceptual overview behind the macroeconomic modeling work, including a view of a nature-economy system that values natural capital.

Chapter 3.2 presents an overview of the modeling approach and explains the framework of analysis and how the two scenarios—Business-as-Usual (BAU) and Green Economy (GE)—were developed. The analytical methods and modeling tools used for different aspects of the analysis are also presented here.

Chapter 3.3 presents the quantitative findings generated by modeling of the two scenarios. The chapter begins by presenting the simulation of changes in forest cover associated with both the BAU and GE scenarios. It goes on to describe the results of the integrated, cross-sector macro analysis, including impacts on growth and equity as well as investment findings. Finally, results from modeling the impacts of BAU and GE scenarios on natural capital are presented.

Part IV

Part IV discusses the leading role of governments in delivering the green economy. Chapter 4.1 starts out by presenting the current state of affairs in delivering a green economy, particularly the challenge of mainstreaming natural capital into national and sub-national efforts. It describes the need to mainstream natural capital into national and sub-national planning and policy making. The only part of the report organized according to political boundaries, this chapter describes recent steps taken by Brunei Darussalam, Indonesia (Kalimantan) and Malaysia (Sabah and Sarawak) to move towards a green economy, along with key further steps needed.

Chapter 4.2 provides an example of an economic policy package that would sustain HoB's ecosystems and biodiversity. It outlines a range of economic instruments that could be employed to drive green growth in the HoB when implemented in synergy.

Chapter 4.3 presents a set of proposed targets and indicators for measuring success in transitioning to a green economy.

Part IV concludes (Chapter 4.4) by looking at the broader, enabling role of governments beyond the development of economic policies.

Part V

Finally, part V goes beyond the role of government to discuss a wide range of solutions and actions that need to be taken by various stakeholders. It begins with chapter 5.1, which discusses on-the-ground and cross-cutting solutions, including specific investments and other actions meant to enhance natural capital. It presents a mix of possible actions by various stakeholders.

Chapter 5.2 sets out potential roles of key stakeholder groups, including business, civil society, the global community and media.

Chapter 5.3 describes a way forward, presenting a series of critical next steps for success based on five success factors and aligned with the priorities contained in the three-country action plan.

Finally, chapter 5.4 concludes the report, noting that a carefully constructed roadmap would help to facilitate the joint efforts of the three HoB countries to advance to a green economy.

END NOTES PART I

[1] Government of Brunei Darussalam, Government of Indonesia and Government of Malaysia. 2010. *Financing the Heart of Borneo, A partnerships approach to economic sustainability.*

[2] Forests that reproduce naturally, without regeneration efforts by humans either through sowing or planting.

[3] United Nations. 2005. *Millennium Ecosystem Assessment - Ecosystems and Human Well-being: Synthesis.*

[4] Johnson, J. 2012. *World Wildlife Fund's Environmental Economic Series, Assessing the Impact of Climate Change in Borneo.*

[5] These are the sizes of the HoB landscape in respective countries to date.

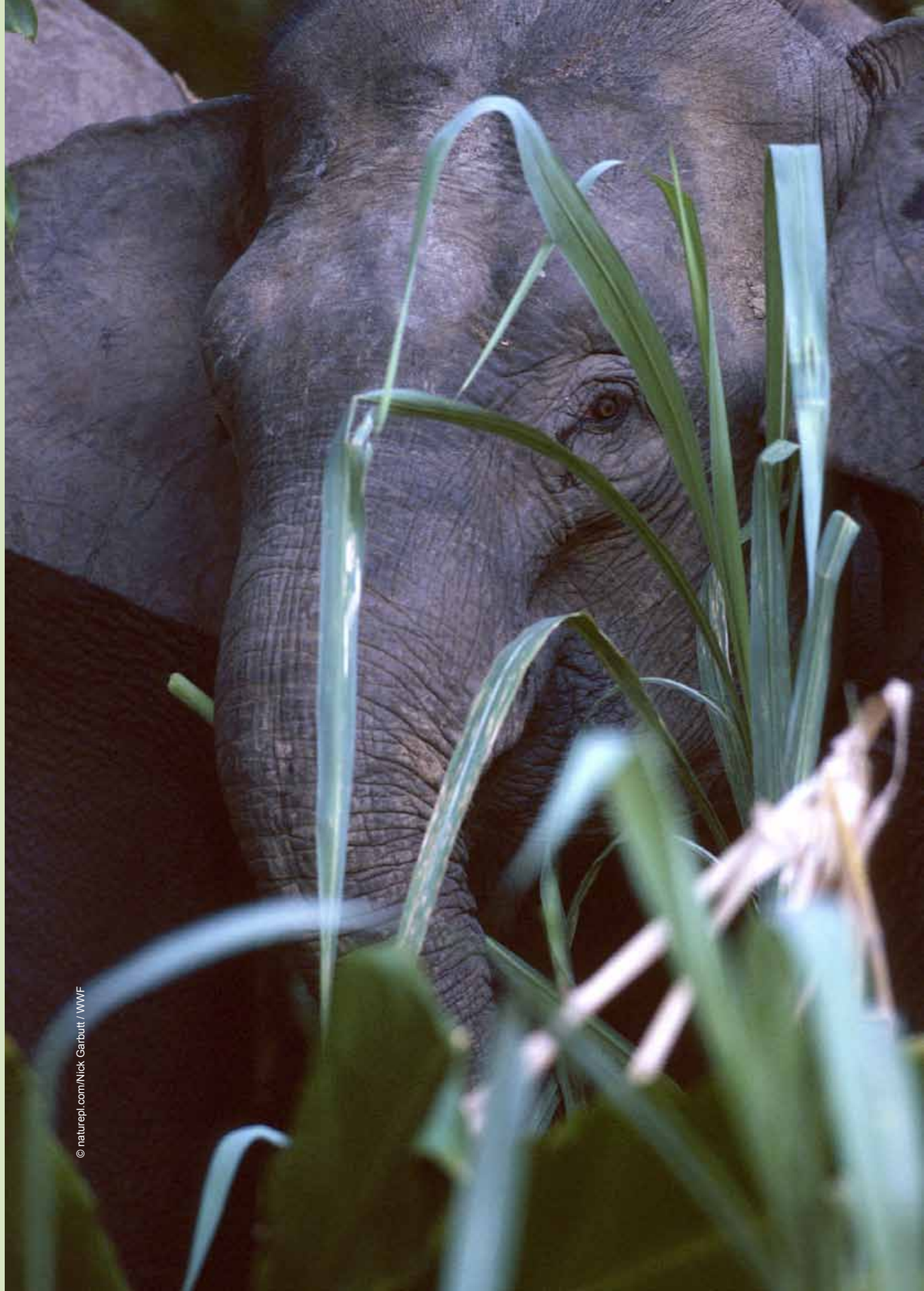
[6] TEEB is a global initiative which is focused on drawing attention to the economic benefits of biodiversity, highlighting the growing cost of biodiversity loss and ecosystem degradation and drawing together expertise from the fields of ecosystem science, economics and development policy to support the mainstreaming of biodiversity and ecosystem considerations in development policy-making.

[7] See www.teebweb.org for more information.

[8] These are: Government of Brunei Darussalam, Government of Indonesia and Government of Malaysia. 2009. *HoB Transboundary Action Plan*; Government of Brunei Darussalam. 2009. *Project Implementation Framework Negara Brunei Darussalam, 2008*; Government of Indonesia. 2010. *Indonesia HoB Strategic Action Plan*; State Government of Sabah. 2010. *Sabah HoB Plan of Action*; State Government of Sarawak. *Sarawak Heart of Borneo Project Implementation Framework*. Unpublished report.

[9] PWC and WWF. 2011.*Towards a Roadmap for a Green Economy in the Heart of Borneo. A scoping study*.

[10] Witteveen+Bos and WWF. 2011. *Quick scan watershed services – Heart of Borneo. Technical Report*.



PART II:
THE HOB'S ECOSYSTEMS AND BIODIVERSITY AND THE CURRENT ECONOMY

Part II:

The HoB's Ecosystems and Biodiversity and the Current Economy

Overview

Part II describes the current HoB economy and its complex, interdependent relationship with HoB's ecosystems and biodiversity. It includes four chapters:

Chapter 2.1 presents the theoretical and methodological framework for the report, including the concepts of natural capital, ecosystem goods and ecosystem services. The chapter describes an economy-nature disconnect, according to which conventional economic analysis has tended to overlook the extensive contributions of nature to economic activity. It also presents the impact pathways through which reliance on natural capital can affect the economy and vice versa.

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FIGURES

TABLES

BOXES

2.1 THE ECONOMY— NATURE DISCONNECT

What's in this chapter

- The conceptual relationship between nature and the economy, including the economy's reliance on, and impacts upon, natural capital
- The concepts of natural capital, ecosystems goods and ecosystem services
- How conventional economic analysis overlooks the contributions of nature to economic activity
- Impact pathways of economies that do and do not value natural capital

People have long taken nature for granted, particularly the important role of ecosystem services in supporting economic development. While the role of nature as a provider of raw materials is more commonly recognized, the role of ecosystems in maintaining key services such as water purification, pest control, soil fertility and carbon sequestration remains largely unrecognized and unrewarded. Failing to account for the full value of nature has inevitable long-term impacts, including resource depletion and environmental degradation, which themselves impact negatively on the economy. Figure 2.1 conceptualizes the relation between nature and the economy.

The circle on the left-hand side of the figure presents natural capital, representing all the aspects and components of nature that may be used to transform materials, or the spatial configuration of materials, in order to enhance the welfare of humans. Natural capital is thus indispensable to economic growth and human well-being. The term natural stocks refers to all the resources provided by nature, including forests, minerals, soil, water, etc. Natural stocks drive the flow of ecosystem goods and services. In this report, ecosystem goods are defined as tangible commodities directly obtained from ecosystems, e.g. timber, food and medicine[2]. Ecosystem services refer here to the intangible benefits that people receive from the dynamics within an ecosystem, including so-called regulating (e.g. water purification), supporting (e.g. nutrient cycling) and cultural (e.g. aesthetic) services[3].

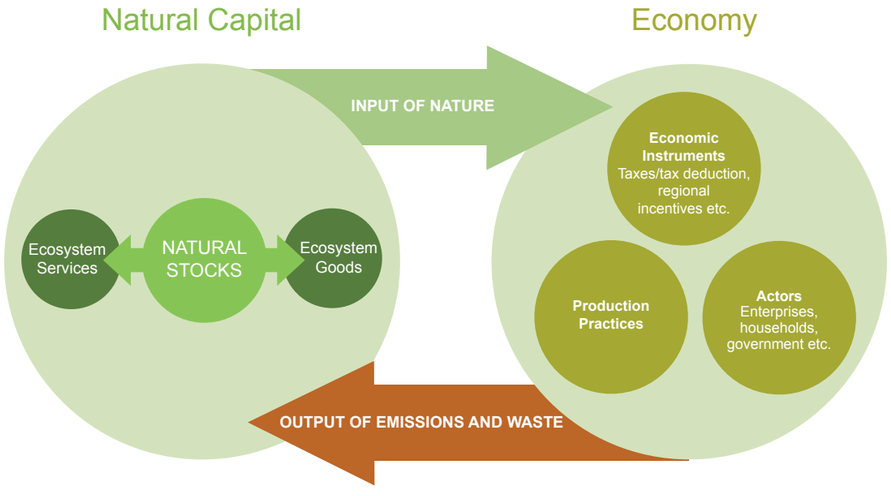

Figure 2.1: The conceptual relation between nature and economy[1]

The circle on the right-hand side of the figure shows the economy, comprising actors, production practices and economic instruments and institutions. Actors include households, enterprises, the government or any other entity that engages in economic activity, either through the provision or consumption of goods or services. Production practices constitute the economic activities and technologies that lead to the provision of goods and services (for consumption). Finally, economic instruments and institutions are man-made interventions and regulations governing economic activity through the assignment of property rights, legal obligations, financial incentives and disincentives.

Interactions between natural capital and the economy—as depicted in the figure by arrows—represent the input and output flows of the economy. Inputs to the economy such as ecosystem goods and services flow from natural capital to the economy, while emissions and waste flow out from the economy back to nature.

Ensuring a continuing flow of goods and services from an ecosystem typically requires that biological and abiotic components remain relatively intact; the structure and diversity of the system are thus important features of natural capital. However, these features are often not captured when describing or disaggregating natural stocks. Moreover, some of these qualitative characteristics of ecosystems may be considered as what economists call public goods; they are to a large extent non-rival (use of the good by one does not prevent its simultaneous use by another), non-exclusive (it is not possible to prevent non-payers from using the good) and therefore not part of the market economy. Because these goods have no prices, they are rendered valueless by our economic system.

Most economic development plans and growth strategies fail to take full account of the fact that a good deal of economic growth takes place at the expense of excessive depletion and degradation of natural capital. As a result, these plans ignore the consequences of such growth for the quantity and quality of ecosystem goods and services that nature provides. These consequences ultimately affect both production and consumption. Economic growth—to the extent that it depletes natural wealth–can impose significant economic and social costs on current generations while presenting important risks and challenges to future ones.

Conventional economic analysis has tended to overlook the contributions of nature to economic activity.

As in many economies around the world, nature's critical contribution to a resilient and growing economy has been largely ignored in Borneo. Forest clearance for commodities such as oil palm has resulted in loss of biodiversity and contributed to water supply problems downstream as a result of water use and fertilizer and pesticide application. Across the island, economic effort and capital have been misallocated to activities which decrease natural capital; natural capital has been lost as financial capital has poured into property, production and export of fossil fuels and other extractive resources, such as forestry and minerals. Price subsidies and other so-called perverse incentives have further helped to stimulate an unsustainable economic development path. Relatively little has been invested in renewable energy, energy efficiency, public transportation and infrastructure, land tenure security, improving social equity, sustainable agriculture, ecosystem and biodiversity protection and land and water conservation. Widespread unvalued and unmanaged negative externalities—the negative environmental side-effects imposed on third parties by economic activities—mean that there is little incentive for the business sector to opt for sustainability. As a result, negative impacts are imposed on HoB ecosystems, biodiversity and on the quality of individuals' health and life.

The man-made causes of environmental deterioration vary, but at a fundamental level they share a common root: the disconnect between economy and nature. The current economy fails to fully value the benefits that natural capital provides to society and to the economy.

The Heart of Borneo Initiative is a prime example of a coordinated transboundary approach to conservation and sustainable development.

A key step in transforming this situation is to recognize explicitly nature's role in economic production, innovation, value creation, stability and prosperity. Ecosystem goods and services from the HoB are essential inputs to the economies of Brunei, Kalimantan, Sabah and Sarawak. If well managed, natural capital can increase sectoral productivity; on the other hand, productivity can decrease if natural capital is poorly managed. Likewise, the better the condition of natural stocks, the more these stocks can be relied upon to support long-term economic growth.

Of course, the value of nature is not defined simply in relation to our economic system. 'Value' can be thought of in different ways. Only a part of it can be captured in an economic assessment such as this and only some of that value can, or even should, be expressed in monetary terms.WWF[4] recognizes that the natural environment has many different kinds of value, only some of which can be usefully measured in monetary terms. Different people value nature in different ways, and nature has an intrinsic value which goes beyond that attributed by humans. It is therefore necessary to employ a variety of methods to value ecosystems and biodiversity to ensure that these multiple aspects are taken into account in economic and government decision-making. For the purpose of this report, we have monetized where possible and appropriate in order to use economic modeling and to show the impact of incorporating some parts of the value of 'ecosystems' within the HoB economy.

Monetary valuation is therefore one of a range of tools used to demonstrate that conservation of ecosystems is essential to long-term economic security and human well being. However, it is important to recognize the limitations of quantifying ecosystems in this way and ensure that such results are not applied where inappropriate. Certain elements of economic value, as well as intrinsic, cultural and other values, will therefore not have been taken into account here because of the nature of the methodology used. This study highlights these more intangible aspects, but subsequently narrows the scope to an analysis in which the economy is central and enables policy implications to be drawn. Further, more extensive research at a broader scale—supported by appropriate data collection and management—could be used in any follow up studies.

Figure 2.2 below compares the impact of an economy which does not value natural capital with one that does. Poor landscape management is commonplace in the current economy (left hand side), which to a large extent is driven by deforestation and environmental degradation from unsustainable timber harvesting, clearing of natural forests for palm oil cultivation and irresponsible mining. Uncertainty in land tenure, overlapping concessions (i.e., overlapping claims on holdings due to issuance of multiple licenses at the same location), poor planning and weak enforcement are additional drivers causing deterioration of ecosystem services. Fire and haze are further results of poor landscape management, which cause further impacts on ecosystem services and have important socio-economic consequences. Poor landscape management results in costs which burden society, particularly forest-dependent communities; considerable investments may be required to offset the losses incurred. Many of these factors are characterized by an unequal distribution of the monetary benefits from nature as well as an unfair distribution of the costs of degradation and resource depletion.

In the HoB, many of the socio-economic impacts on the left side of the figure, e.g. loss/availability of water, may in the short term impact only selected industries, such as drinking water utilities and sectors which use river transportation. However, in the longer term, depletion of forest, soil and water resources and their essential services will significantly impact natural capital, eroding its capacity to sustainably provide many of these ecosystem goods and services. These impacts feed back to the sectors themselves–causing parallel erosion of their long-term economic prospects and viability. Such mismanagement of natural capital leads to lower economic value and higher costs.

This vicious cycle can become virtuous by following the pathway shown on the right-hand side of Figure 2.2[5]. Conservation and sustainable management in the HoB can increase the production and overall value of ecosystem goods, while avoiding damages to ecosystem services and their resulting costs.

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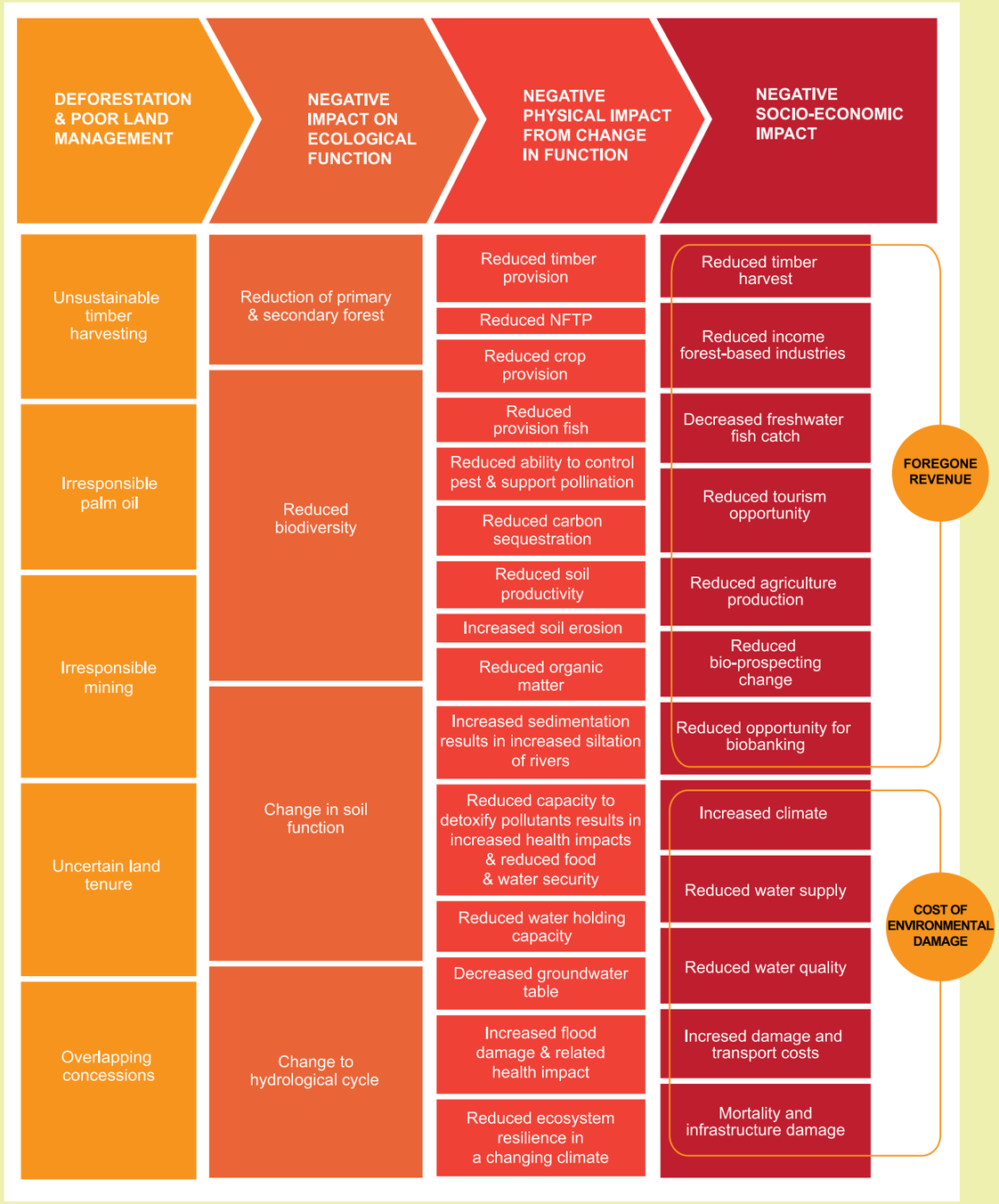

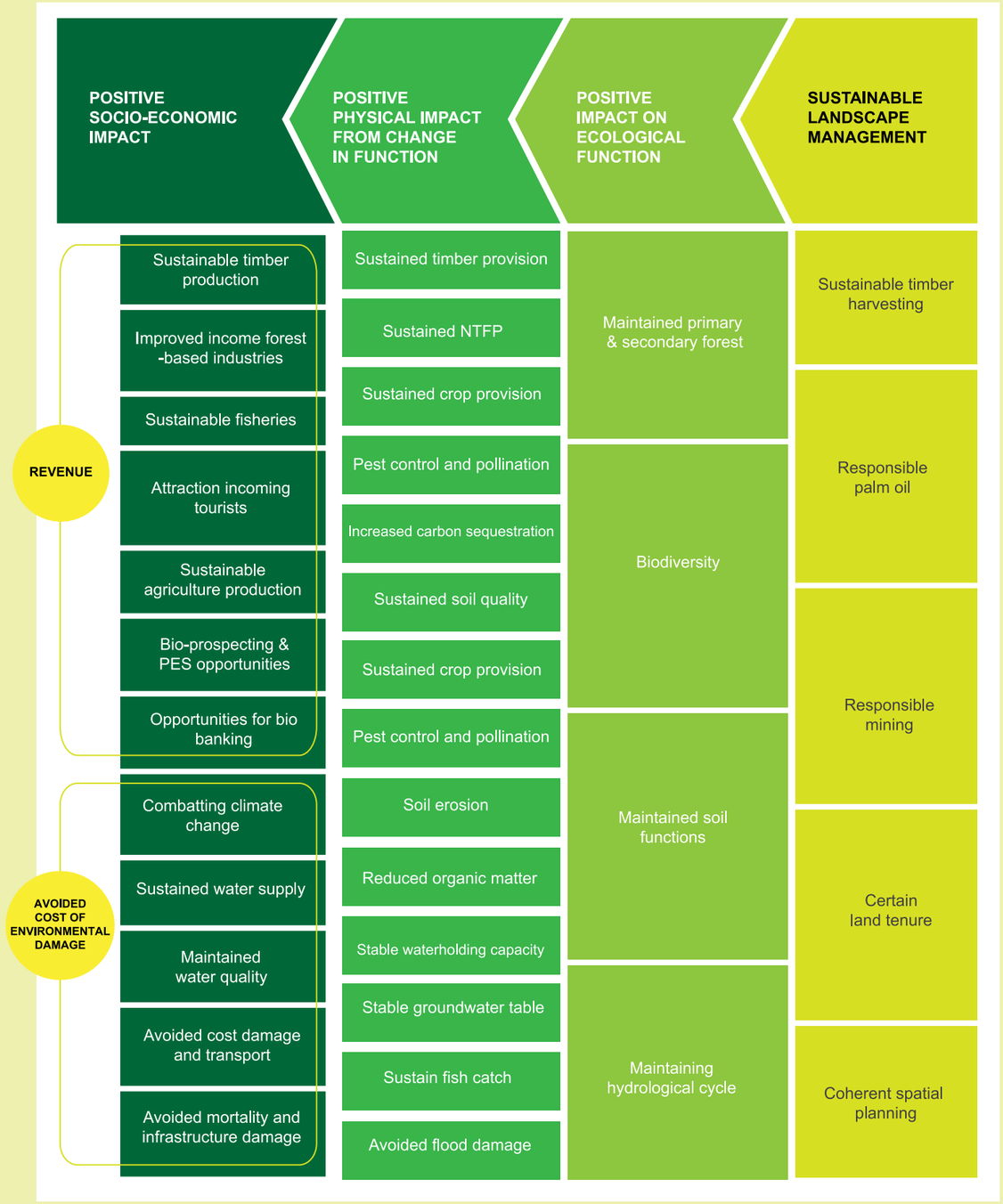

Figure 2.2: Impact pathway of an economy that does not value natural capital (left) and an economy that does value natural capital (right)

As we have seen, the economy relies on natural capital as a source of production inputs. In turn, production processes impact natural capital. As the negative impacts of economic activity cause natural capital stocks to decline, ecosystem services are degraded and there is less potential to generate revenue. With reduced natural stocks, and the added costs associated with the loss of ecosystem services, economic activity is adversely impacted.

On the other hand, where economic activity does not degrade natural stocks, or even enhances them, e.g. through investment in natural capital, negative consequences on the sustainability of economic activity are avoided and growth may be enhanced. Figure 2.3 below illustrates how changes in natural capital stocks can be felt across economic sectors through changes in inputs and services provided. The circular shape of this diagram implies the possibility of an economy and natural capital providing goods and services to one another on a sustainable basis.

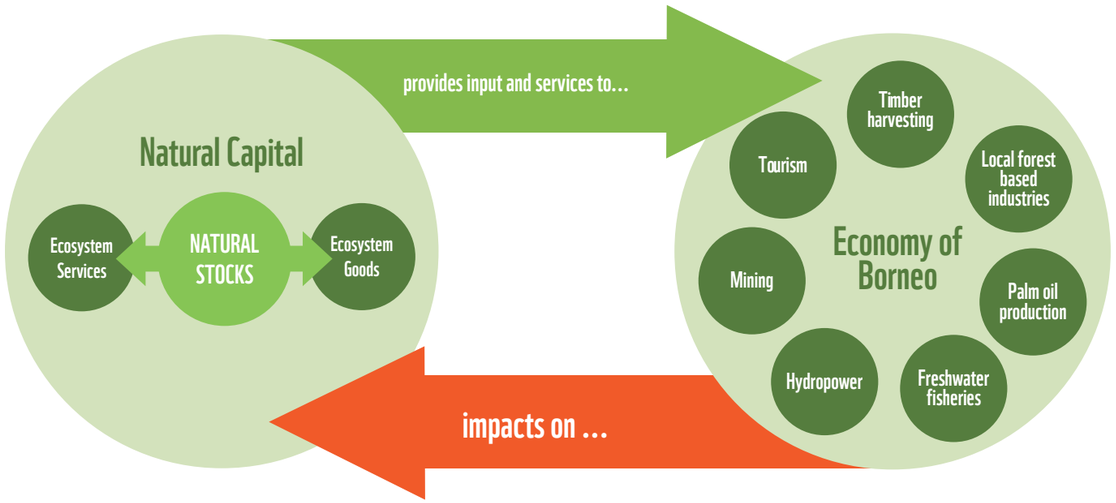

Figure 2.3: Dependence and impact of sectors on natural capital

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2.2 THE VALUE OF HOB'S ECOSYSTEMS AND BIODIVERSITY

What's in this chapter

- A qualitative picture of important, non-monetized values of the HoB
- Values discussed include biodiversity, ecosystem resilience in a changing climate, water-related ecosystem services, social values, micro-climatic regulation and carbon sequestration

Biodiversity

Borneo's biodiversity possesses unique intrinsic value; it encompasses the variety of ecosystems, natural communities, species, subspecies, populations and genetic resources found on the island. The HoB contains some of the world's most biodiverse forests, which are home to unique and charismatic species including pygmy elephants, orangutans, rhinoceros and clouded leopards. More than 350 species of birds, 150 reptile species and 15,000 flowering plant species are native to Borneo's forests. Many are found nowhere else on earth[6]. More than 600 new species of animals and plants have been discovered since 1995, indicating just how much remains to be learned about the animals and plants found in the HoB[7].

Biodiversity is an essential building block of ecosystems in general and underpins the food security of forest-dependent communities[8]. HoB's genetic resources and agro-biodiversity have long been used, cultivated, managed and modified by local people. More information on the importance of biodiversity for food security can be found in chapter 2.3 on the local forest-based enterprises and freshwater fisheries. While it remains difficult to calculate the total economic value of biodiversity, including ecosystems with a rich variety of species, there is little doubt that biodiversity is extremely important for the economies of both local and global communities. In addition to harboring genetic resources and economically valuable products, biodiverse ecosystems are valuable due to their greater resilience to climate change[9].

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To date, species biodiversity has been most severely affected by deforestation. Southeast Asia has the highest rate of deforestation of any major tropical region, and is projected to lose three quarters of its original forests and 42 per cent of its biodiversity known at the time of study by 2100[10]. Tree species richness in Borneo has been shown to be negatively associated with the intensity of logging activities; in addition, logged forests are often slow to regain their previous plant diversity[11].

Biodiversity forms the foundation of every ecosystem and of the ecosystem services on which humans depend.

Biodiversity is an essential building block of a green economy.

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Ecosystem resilience in a changing climate

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Mohamed Jerome Robles, 37, Miri, Sarawak, Malaysia:
Mohamed has observed the impacts of a changing climate in Miri, Sarawak: “There does not seem to be a distinct monsoon season anymore. The rain is more frequent, random and certainly more intense…. now we are afraid of flash floods and strong winds which accompany the intense rains.”

Figure 2.4: An economy that values natural capital has more resilience in a changing climate

In the face of climate change, Borneo is expected to experience sea level rise, extinction of species (especially marine and amphibian), increased risk of floods and forest fires, human health impacts, changes in agricultural yields and damage to infrastructure. Conservation and sustainable management in the HoB can help build resilience to climate change.

The resilience of an ecosystem can be described as its capacity to resist change and to recover following a disturbance[12]. Resilience to changing environmental conditions is determined by an ecosystem’s biological and ecological resources, in particular: (i) the diversity of species, including micro-organisms, (ii) genetic variability within species (i.e. the diversity of genetic traits within populations of species), and (iii) the regional pool of species and ecosystems[13]. Resilience is further influenced by the size of the ecosystem in question: the larger and less fragmented, the more resilient. Finally, the condition and character of the surrounding landscape plays a role.

While climate change is predicted to affect surface temperatures in the tropics less than the global average[14], it is nevertheless expected to have undesirable economic and social impacts, particularly within more vulnerable segments of society, many of whose members depend heavily on ecosystem services and on biodiversity itself. Many tropical species are thermal specialists, adapted to a narrow range of temperature variation. A study of Australia’s wet tropics found that significant changes in species richness occur with just one degree celsius increase in global temperature. With this change in temperature, areas of highland biodiversity remain largely intact, but lowland and mid-altitude species diversity declines[15].

Maintaining and restoring forest biodiversity promotes the resilience of forest ecosystems to human-induced pressures and is therefore an essential safeguard against expected climate change impacts. Ecosystems are more likely to withstand exposure to changing climate if they are healthy, meaning that their components (e.g. canopy species, understory species, pollinators, seed dispersers, top predators, etc.) and associated ecological functions (e.g. large enough for natural disturbance processes, seed dispersal, pollination, predator-prey relations, etc.) are intact.

Borneo is expected to experience a variety of impacts related to climate change, including sea level rise, extinction of species (especially marine and amphibian), increased risk of floods and forest fires, human health impacts, changes in agricultural yields and infrastructural damage[16]. Healthy, intact forests are more likely to absorb and adjust to changing climates, as they have done for many millions of years. Primary forests are more resilient than modified natural forests or plantations. Increasing biodiversity in planted and semi-natural forests will increase their resilience and productivity (including carbon storage). Ecosystems that are degraded or are otherwise missing key components are more likely to unravel when faced with additional stresses associated with more intense and/or more frequent climate variability and disturbance.

In the face of such prospective changes, ecosystem resilience will support the economy and society by creating buffers. Economies, too, are more capable of withstanding changing conditions in the economic landscape when they are diversified. As virtually all economic sectors are linked to the environment in one way or another, sustainable landscape management in the HoB will support resilience within the economy.

Water-related ecosystem services

Rainforests such as those in the HoB provide important watershed services, such as provision of clean water, maintaining soil quality, reducing erosion, regulating overland flow, maintaining groundwater and preventing floods. These services regulate the availability and timing of water supplies downstream.

The rivers originating in the HoB provide water to 29 river basins, supporting households and economic sectors on an area of 54 million ha (more than 70 per cent) of the island of Borneo for the benefit of over 11 million people. The HoB ensures water security for an area almost 2.5 times its size. The loss of forests in its upstream ecosystems will therefore impact lives and livelihoods far downstream and well beyond the boundaries of the HoB itself.

Rainforests such as those in the HoB provide an important water management service by retaining soils, promoting groundwater and river replenishment and preventing floods.

Poor landscape management by some sectors—particularly unsustainable logging, unsustainable palm oil cultivation, expansion and irresponsible mining—results in a loss of these important ecosystem services, with impacts on other sectors and society at large. The impacts and costs to the economy and society related to loss of these ecosystem services are described in more detail in Chapter 2.4 below.

Figure 2.5: River basins originating in the Heart of Borneo[17]

Social value of forested ecosystems

The aesthetic, cultural, spiritual, heritage, enjoyment and educational value of the HoB may be grouped together under the heading of social value of natural capital. Several ethnic and sub-ethnic groups collectively known as Dayak are important beneficiaries of these values, as their culture and way of life is shaped by the forest; as a result, they both are impacted by changes in the forest ecosystem as well as have impacts on it.

There is an innate social connection between the Dayak and their forests, which goes well beyond the latter's importance for subsistence and also beyond the designation of certain land as 'sacred' sites. For centuries, the Dayak have managed the forests, rivers and wetlands of their customary land, claimed individual and collective tenure rights, used and traded forest products, hunted wildlife, cleared agricultural land by engaging in cyclical practices like swidden and wet-rice cultivation, developed agroforestry regimes and agreed on regulations for how to sustain the sources of their livelihoods. Traditionally, individual claims to land were established by cutting trees or clearing forest. The right to use agricultural land, such as rice fields and gardens, have been passed on to successive generations and remembered by the community[19].

An important social value of the forest is the centuries-old traditional knowledge associated with the use of forest products and resources. The genetic resources and agro-biodiversity of the HoB have been used, cultivated, managed and modified by local people. This rich tradition—codified in language, plant names, local pharmacopeia and recipes—has made possible the identification and recognition of the uses of plants and other organisms for food and medicinal purposes. Traditional knowledge represents a social value which has not yet been assessed nor valued by markets, resulting in foregone benefits for the holders of such knowledge. Traditional knowledge associated with agricultural methods and exploitation of wild plants has long helped indigenous and local peoples cope with extreme weather conditions and environmental change, and can therefore help guarantee future food security and make agriculture more resilient to the effects of climate change. Traditional methods include using local plants to cure diseases and control pests, as well as choosing and breeding crop varieties which can tolerate extreme conditions such as drought and floods. The use of these traditional crops and practices, and associated knowledge of uses of biological diversity, are the foundation of resilience among human communities living in the HoB forests.

There are costs associated with the loss of social value of the HoB forest. These include:

- costs generated by expanding agribusiness, timber exploitation and mining in customary lands, which limit access to resources by local residents;
- costs associated with an increase in local social conflicts over land and resources, including increased transaction costs and the value of the resources destroyed in the process;
- costs and impacts associated with people suddenly being deprived of their main sources of livelihoods, including increases in poverty, and the additional social spending that government needs to allocate to provide for the increased number of poor;
- opportunity costs—not fully replaced by benefits from alternative forms of employment in plantations, etc.—imposed on local residents who must forego benefits related to extraction, harvesting and trade of non-timber forest products (NTFPs), when their customary lands are exploited by enterprises owned and run by outsiders, and;
- costs related to the 'exploitation' of landscape beauty and cultural values of the HoB for ecotourism purposes by outside investors, particularly in cases where only a small portion of economic returns generated are retained at local level and where local people do not control businesses.

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Anye Apui, Customary Chief of Hulu Bahau, Malinau, East Kalimantan, Indonesia[18]

'Timber is gold, but this is not the kind of gold that is good for us. I want to protect the forest in my area, as the forest is life for Dayak people.'

Regional and micro-climate regulation

Well-managed forests result in cooler surface temperatures under extreme weather conditions and help regulate micro climates. Although efforts have been made to assign an economic value to this service in both urban areas[20] and within ecosystems[21], its importance is not regularly taken into consideration when considering the economic value of intact ecosystems. Nevertheless, the climate regulation function of forests provides significant benefits to the economy and people of Borneo.

According to climate change predictions, HoB ecosystems will experience a host of impacts which may endanger the area's economic productivity. Maintaining consistent micro-climatic conditions, such as moisture levels and air and soil temperature, is important to ensure ecosystem resilience to such change. Changes currently underway in the HoB are disrupting and simplifying complex ecological structures and functional linkages, reducing the capacity of the system to disperse and absorb energy and resulting in impaired provision of ecosystem services, as well as increased local warming[22].

Carbon sequestration for global climate change mitigation

Carbon is stored in two major terrestrial 'pools': plant biomass and soils. Vegetation in the HoB absorbs carbon dioxide from the atmosphere through photosynthesis and stores it in the form of organic matter in plant and root biomass. These organic materials partially decay over time, and soil organic matter forms a large carbon pool, especially in peatlands, but also in other soils. Plant biomass and soil thus provide an important carbon sequestration, or storage, service that helps to mitigate climate change. In soils, this carbon pool provides the added services of increasing nutrient and water retention capacity and protecting groundwater from contamination[23].

Globally, deforestation and forest and peatland degradation result in significant greenhouse gas emissions. Deforestation and forest degradation account for up to 18 per cent of global greenhouse gas emissions, more than the entire global transportation sector and second only to the energy sector[24]. In light of growing concerns about climate change, the carbon storage and ongoing sequestration functions of forests are beginning to acquire a financial value. HoB's ecosystems store immense quantities of carbon and play an important role in carbon sequestration. Based on above ground biomass only, across the three countries, the HoB landscape stores an estimated 3.2 billion tonnes of carbon (11.8 billion tonnes of CO_2 equivalent, henceforth 'CO_2e'), of which 52.1 million carbon (191.1 million tonnes of CO_2e) are found in Brunei, 2.4 billion carbon (8.9 billion tonnes of CO_2e) are in Indonesia and 754.7 million tonnes of carbon (2.8 billion tonnes of CO_2e) are in Malaysia (Figure 2.6)[25].

Rich tropical forest resources in the HoB can benefit from mechanisms such as the programme being developed under the United Nations Framework Convention on Climate Change (UNFCCC) to compensate developing countries for reducing emissions from deforestation and forest degradation (REDD+). REDD+ is meant to provide financial benefits to government, companies and local communities to improve forest management. REDD+ is considered one of the more promising instruments to stimulate changes in the economy and the restoration and maintenance of the HoB's natural capital.

HoB forests play a role in regional and micro-climate regulation. Current land conversion and economic activity such as monoculture plantations simplify the complex structures and linkages in the forest ecosystem, with a direct impact on the ecological functions it performs.

The REDD+ scheme is expected mainly to financially value forest carbon in cases where governments or specific projects can implement changes in land use management practices that reduce expected carbon emissions or increase carbon sequestration. Parts of the HoB landscape include forested areas zoned for clearance and development. These have a financial value in the REDD+ scheme. Forest and soil

degradation in the HoB also occurs in legally protected areas, which may be encroached upon due to poor governance[26]. However, these do not seem to be financially valued in the current scheme. Strategic land and protected area management interventions in these areas could contribute to achieving national GHG emission reduction targets and be eligible for payments under REDD+ financial schemes (Box 2.1 below, illustrates how specific interventions on land allocated for development of forestry in Indonesia's HoB Strategic National Area can contribute to national emission reduction targets).

An economy that fully values natural capital would recognize HoB's ecosystems for the many goods and services they provide to society, not only for the benefit of global climate change mitigation.

Box 2.1: Potential contribution of the HoB Strategic National Area to reduction of emissions in Indonesia[27]

A rapid assessment of potential land management interventions indicates that HoB forests within the HoB Strategic National Area (KSN HoB[28]) in Indonesia could potentially contribute to Indonesia's action plan to achieve emission reductions RAN-GRK[29] by avoiding emissions of 941.7 million tonne of CO_2 equivalent (Mt CO_2e).

At a conservative carbon price of US$2/tonne, the total value is US$513.2 million or US$51.3 million/year over 10 years.

INTERVENTION 1: Safeguarding forested palm oil concessions by prioritizing palm oil development on degraded lands
According to oil palm permit data[30], there are 359,355 ha of palm oil concessions within the HoB in Kalimantan which are in forested landscapes, two thirds of which are located in West Kalimantan Province. Prioritizing oil palm development on already degraded land and safeguarding these forests would avoid emissions of 134.7 Mt CO_2e (36.7 million tonnes of Carbon (MtC)).

INTERVENTIONS 2 AND 3: Protecting and restoring inactive logging concessions
Many inactive logging concessions in Kalimantan retain operations licenses but do not have a harvesting permit or are no longer active. These concessions are at risk of illegal logging, degradation, and fire without the active management provided by a Forest Management Unit (FMU). Many of these logging concessions have natural secondary forest, albeit in a degraded condition. The average biomass in t/ha was estimated for these concessions to identify the inactive concessions that are a priority for protection based on their natural capital. Criteria used to assess the inactive logging concessions in Kalimantan based on biomass included: potential restoration - low biomass < 150 tonnes/ha; potential restoration – medium biomass 150-200 tonnes/ha; potential protection – biomass > 200 tonnes/ha.

- Based on logging permit data in the HoB and assuming carbon sequestration of forests with a biomass > 200 tonnes/ha is 180 tonnes of carbon/ha, protecting 464,700 ha of forests currently under inactive logging concessions could lead to avoided emissions of 307 Mt CO_2e.
- There are 13,700 ha of inactive logging concessions with forest biomass between 150-200 tonnes/ha in the HoB part of East Kalimantan. If this area were restored, an additional one million tonne of carbon would be sequestered, or 4Mt CO_2e emissions avoided after 15 years. Assuming that this area sequesters 73,800 tonnes/year or 5.4 tonnes/ha/year, it could sequester an additional 738,000 tonne of carbon (2.7 Mt CO_2e) by 2020.
- In HoB West Kalimantan, 53,000 ha has forest biomass below 150 tonnes/ha. Restoring this area would sequester an additional six million tonnes of Carbon (22.1 Mt CO_2e) after 25 years. Assuming that this area sequesters 241,000 tonnes/year or 4.5 tonnes/ha/year, this area could sequester an additional 2.4 MtC (8.8 Mt CO_2e) by 2020.

INTERVENTION 4: Successful implementation of FSC certified logging concessions
There are 448,000 ha of FSC certified logging concessions in the HoB, with an average biomass of 144 tonnes of carbon/ha. If these were to successfully apply FSC certification by 2020, they could sequester an additional 13.8 MtC (50.8 Mt CO_2e) over 10 years.

INTERVENTION 5: Certifying all non-FSC concessions
There are four million ha of logging concessions which are currently not FSC certified. If these were to become certified, they could sequester an additional amount of 119.2 MtC (437.4 Mt CO_2e) over 10 years.

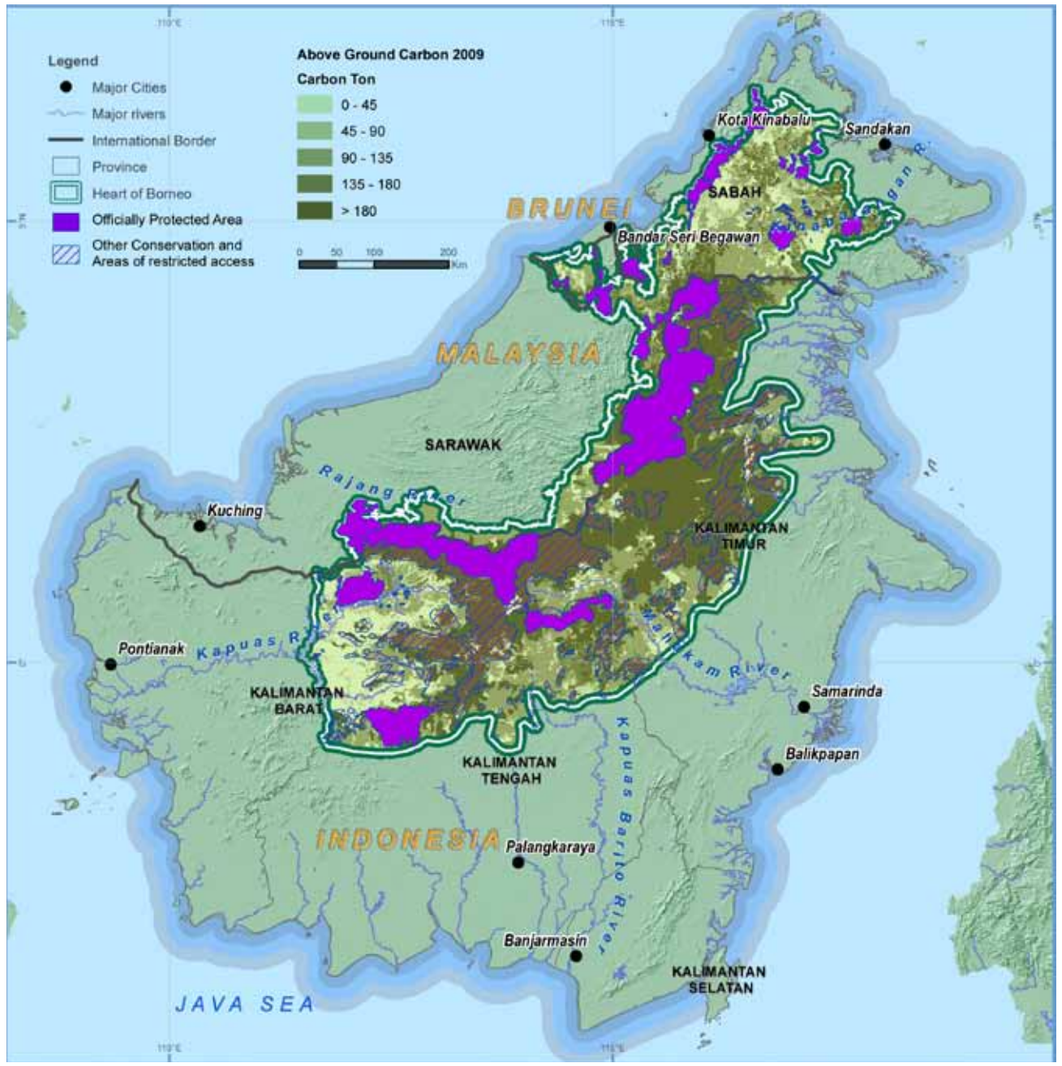

Figure 2.6: Above ground carbon stock in the HoB—not financially valued in the current economy

2.3 ECONOMY – NATURE INTERDEPENDENCE: A SECTORAL OVERVIEW

What's in this chapter

- A sectoral overview of economy-nature interdependence.
- Seven sectors—timber supply, palm oil, mining, local forest-based enterprise, freshwater fisheries, hydropower and tourism—are described.
- Purposes are: first, to better understand the impacts of unsustainable practices within the sector on natural capital, and; second, to understand the feedback effect that declining natural capital is having on the sector.

Borneo's economy is dependent to a significant extent on HoB's natural capital. Extractive industries in the HoB often appear to be profitable because many costs are externalized and resource rents are not collected. Most businesses do not take into consideration the costs and benefits of ecosystem services, even though degradation in ecosystem services can negatively impact their operations and profitability. Some industries may currently be paying for services, such as water treatment or dredging, that a well-managed and functioning ecosystem would provide at a lower cost.

This chapter describes the HoB's economy-nature interdependence, in particular the importance of certain natural capital values to specific economic sectors. The relationship is illustrated through a snapshot of seven interdependent sectors. These sectoral summaries illustrate the economic and social importance of each sector, its trajectory over time and, in particular, the relationship between the sector and natural capital. Both the sector's impacts on natural capital, as well as the impacts on the sector of a decline in the natural resource stock, ecosystem good or service, are described. It is worth noting that the loss of ecosystem services may be due to activities within the sector itself, activities within other sectors, or a combination of both. Thus, the interdependence described extends not only between each sector and natural capital but also amongst the sectors themselves.

The first three sectors described below—timber supply, palm oil cultivation and mining—represent HoB's large-scale, high-impact sectors. These sectors, together with large-scale hydropower and tourism, play important roles in the current economies of Borneo. However, they have a tendency to result in 'economic outflow', in which economic returns accrue to investors outside of the HoB, while relatively little is retained at local level. The owners of those natural and social values run the risk of being reduced to the role of labourers for outsiders who derive most of the profit from their social and natural resources.

The other two sectors described are local forest-based enterprises and fisheries. These are more informal sectors, which are often impacted by large-scale, high-impact sectors, yet remain important sectors capable of contributing to growing local economies.

Timber supply

During the past several decades, large-scale industrial logging across Borneo has dramatically altered the forest landscape and the relationship between humans and the forest. Traditionally, Dayak communities living within the forest made their livelihoods through sustainable use of the forest. Timber was occasionally harvested for sale or for their own consumption as building materials.


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Natural capital on which timber sector depends[31]	Impacts of unsustainable practices of timber sector on natural capital	Impacts of declining natural capital on the timber and other sectors
• Timber supply • Hydrological services • Soil structure • Decomposition services of organic matter • Nutrient cycling	Reduced long-term timber supply for short-term gains; Degraded watershed functions (soil erosion, groundwater recharge, and river sedimentation); Biodiversity loss and carbon emissions.	Timber supply will not support long-term sustainable business operations; Loss of watershed regulation services can impact accessibility, and negatively impact other sectors in the landscape.

The Dayak traditionally employ selective timber harvesting methods which minimize environmental impacts. They deliberately avoid creating gaps much larger than those made by natural tree fall, with minimal consequences for soil, undergrowth, and other vegetation. On slopes, for example, they try to fell the tree along the slope. As commercialism slowly invades traditional societies, trees are now more often being cut for a quick profit in areas where they formerly brought substantial, albeit irregular, income to a village[32].

In recent decades, industrial-scale logging has contributed to rapid deforestation and forest degradation of large areas of Borneo, particular the lowland forests that were most easily accessible. In the mid 1980s, Borneo still retained forest cover of 70 per cent; by 2005, only 50 per cent of the island remained under forest cover. Between 1985 and 2005, Borneo lost an average of 850,000 ha of forest every year. If this trend continues, forest cover will drop to less than a third by 2020[33].

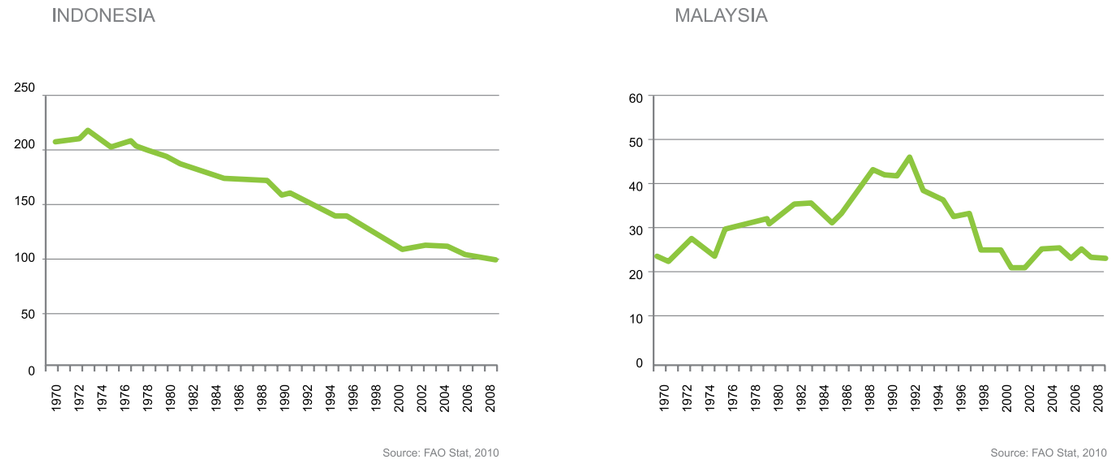

Figure 2.7: Roundwood production in Indonesia and in Malaysia (1970 to 2009)[38]

Even more dramatic are the figures from Sabah, which in 1975 had 5.5 million hectares (or 75 per cent of Sabah's total land area) of unlogged forest. By 1995, this figure had decreased to 3.4 million hectares (58 per cent of total area)[34]. It is true that the forestry sector has, over the last two decades, lifted many households out of poverty. It has contributed to local and national economic growth and has amounted to 2.5 per cent of GDP in Indonesia, 3.0 in Malaysia and 0.1 per cent in Brunei[35]. The sector's contribution to official employment figures on a national scale is 0.9 per cent in Brunei, 0.3 per cent in Indonesia and 2.3 per cent in Malaysia[36].

Unfortunately, unsustainable logging rates, combined with illegal activities, have led to a consistent decline in HoB's valuable timber stocks since the late 1960s and early 1970s when, for example, Sabah was the world's leading exporter of tropical timber[37]. Figure 2.7 above shows the downturn in production of Indonesia and Malaysia's timber industry during the last several decades. In Malaysia, this has led to a stable production output over the last decade; however, in Indonesia a worrying downward trend is continuing.

Unsustainable logging practices can degrade various soil and hydrological services. Forest regeneration is likely to require much larger external inputs and can take much longer. High rainfall intensity in humid climates means that soil erosion potential is very high. Removing trees and disturbing soils causes more overland flow of water and increases sediment transport capacity. An increase in sedimentation flows into the river systems may cause sedimentation downstream and contribute to flooding, restrict river transport capacity and increase the need to dredge (see Chapter 2.3 on costs of lost ecosystem services).

Agro-forestry and agricultural sectors within and beyond the boundaries of the HoB remain highly dependent on well-managed watersheds and associated hydrological and soil-related services. These sectors have often been forced to bear the costs of irresponsible logging practices. Irresponsible logging also reduces the benefits of other goods from forests and river systems. For example, biodiversity-based enterprises that support many local communities rely on healthy and extensive forest areas and healthy streams and rivers.

Timber harvesting will remain an important economic activity in the forests of the HoB. Currently, roughly one quarter of the HoB—5.8 million of 22 million ha—is covered by logging and plantation concessions[39]. Sustainable forest management practices within the sector are a critical element in ensuring maintenance of the region's natural capital. At the same time, the timber/forestry sector remains highly dependent on ecosystem goods and services, particularly ecosystem functions that support forest regeneration, such as soil structure to support plants and roots, decomposition of organic matter, and nutrient cycling, which allows nutrients to be reused for growth by organisms including plants.

Palm oil cultivation

Oil palm was introduced to Borneo by the Dutch and British in the nineteenth century. It was not until the late twentieth century, however, that production moved from mainly small, household plots to large-scale, commercial plantations and expanded rapidly in Indonesia and Malaysia. Today, Indonesia and Malaysia account for more than 85 per cent of the global palm oil supply, and the palm oil industry is an important part of their national economies, representing 4.5 per cent and 3.2 per cent of GDP respectively. The industry


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also provides a significant source of employment for many of Indonesia's and Malaysia's rural poor, employing more than three million in Indonesia and 1.5 million in Malaysia. About one third of Indonesia's and Malaysia's combined palm oil output—or 16 million tonnes—is produced in Borneo[41].

Palm oil is one of the fastest growing sectors in the HoB, and one for which highly ambitious official development plans have been drawn up. The history of palm oil development is one of lucrative profits for large companies, with local communities often giving up land cheaply and, at times, involuntarily. While local communities have for centuries produced export commodities such as rubber, the early oil palm plantations reduced Dayak growers to the status of laborers and more recently smallholders with limited capacity for independent decision making[42]. The severe impact of clearance of natural forests on biodiversity and on traditional use of land by local communities is also well known[43].

Natural capital on which palm oil sector depends[40]	Impacts of unsustainable practices on natural capital	Impacts of declining natural capital on the palm oil and other sectors
• Water supply and other hydrological services • Soil structure • Decomposition of organic matter • Nutrient cycling	Clearance of natural forest (timber value supports plantation development); Heavy fertilizer and pesticide application can result in water pollution; Clearance of natural forest can increase soil erosion disrupting watershed functions (including natural water flows) and causing eutrophication; Clearance of natural forest results in loss of biodiversity and carbon emissions.	Disrupted hydrological cycle can result in water supply issues for palm oil cultivation and mill operation, transport challenges and social problems; Loss of natural forest and potential for sustainable timber production, non-timber forest products, carbon stocks and sequestration; Polluted waterways severely impact freshwater fish and water supply sectors.

Since 2000, the total planted area in Borneo has increased by around 5 per cent per year in Malaysia and by 9 per cent per year in Indonesia, reaching 3.6 million ha in 2008[44]. From 1990–2005, at least 56 per cent of palm oil expansion in Indonesia and 55 per cent in Malaysia occurred at the expense of natural forests[45]. In 2004, in the face of consumer pressure and demands for independent certification, the industry supported the creation of a voluntary association among palm oil producers and other players in the supply chain in order to encourage production according to agreed social and environmental guidelines. While there are limitations to such voluntary initiatives, they illustrate a growing awareness of social and environmental issues amongst businesses and consumers. Another encouraging sign is the development of Low Carbon Growth Plans for East and Central Kalimantan, which include specific plans for emission reductions through palm oil development on degraded areas rather than on forested lands[46]. In recognition of this potential, the establishment of an organization to facilitate land transactions involving palm oil on degraded land is under consideration.

The palm oil industry depends on natural capital in a number of ways: most obvious of these are land, soil and water required for plant growth. In subsequent phases of processing the fruit into products that can be transported and traded, the sector is further dependent on water and on nature's ability to dilute effluent from plantations and refineries. During the several stages of processing, large amounts of energy are also needed, which typically comes from fossil fuels. Technologies such as biogas and biomass gasification are available to replace fossil fuels to a significant extent, but they have yet to be adopted by the palm oil industry except on a very small scale. This is particularly unfortunate given the vast amount of biomass the industry produces as by-products that could be used to produce biofuel (see also "Energy and biogas" in part IV: Green Economy Solutions, Innovative Sectors).

A variety of external costs are imposed by the expansion of the palm oil industry. Conversion and drainage of peat soils in order to expand oil palm production poses a particular problem, as it strips watersheds of their main buffer zones. Lowering groundwater tables cause oxidation of peat, resulting in substantial CO_2 emissions. Drainage also leads to significantly increased fire risk[47].

Loss of natural forests and biodiversity associated with palm oil expansion reduces the capacity of ecosystems to adapt to environmental change and recover from degradation. This is illustrated by the increased vulnerability to disease related to monoculture, in comparison with more biodiverse and resilient ecosystems such as primary forest or even intercropped fields. Increasing development of palm oil on steeper slopes and soil compaction increases overland flow of water and soil erosion (see Chapter 2.4 on costs due to lost ecosystem services).

Many palm oil plantations pollute water sources through the excessive or improper use of agro-chemicals (e.g. no buffer zone along riverbanks) and by dumping palm oil mill effluent (POME), a mixture of water, crushed shells and small amounts of fat residue. POME can negatively affect the health of aquatic ecosystems, including the water used for drinking and bathing by local and downstream communities[48]. Pollution occurs especially during the rainy season, when basins containing POME may overflow, flushing agrochemicals into waterways. The sudden influx of toxins causes the death of local aquatic life, but evidence of the toxic spill dissipates with dilution downstream, making POME overflow events difficult to regulate. POME also releases methane—a potent greenhouse gas—as mill effluents are broken down[49]. In addition, the high nutrient content of the effluent causes a high biological oxygen demand (BOD) as the nutrients break down. Aquatic species are very sensitive to BOD as well as to temperature change in water caused by the effluent. BOD, chemical fertilizers and pesticides have important impacts on aquatic species and on the human nervous system. People downstream from plantations have been known to experience disease and skin problems when using the water for washing and cooking[50].

Mining

Most mining in the HoB consists of surface mining for coal. Gold and diamonds are also mined on a relatively small scale. The mining sector is important on a national and regional scale either for export (Indonesia) or as an essential input for domestic production (Malaysia)[52]. Coal production in Indonesia has grown rapidly in the last decade and is expected to continue growing by 4-6 per cent per annum. Much of this growth is expected to come from Kalimantan, which holds 53 per cent of Indonesia's estimated 4,300 million tonnes of recoverable coal reserves. Some of these reserves are within the HoB, where exploration and some production is already underway. Indonesia is one of the top ten global producers of coal, and with global as well as domestic energy demand growing[53], there is likely to be increased exploitation of coal reserves in the HoB.

Malaysia imports 99 per cent of its coal needs for energy production in the country while the only domestic coal production currently is taking place in Sarawak, in areas outside of the HOB landscape. However, within the HoB landscape, there are coal reserves located within environmentally sensitive areas, such as Maliau Basin and Danum Valley Conservation Area in Sabah. However, these areas will not be exploited due to their status as major world class tourism sites and their being nominated as a UNESCO World Heritage Site. Brunei has significant coal reserves; however, due to its oil wealth, these are not currently exploited. Altogether, there are more than 1.1 million ha of coal mining concessions within the HoB, 980,000 ha of which remain in the research or exploration stage[54].

Mining in the HoB and across Borneo relies on land with the desired deposits and requires large quantities of energy and water for processing before the final product can be transported. To deliver coal to market, mining companies in the HoB typically rely on river-based transport using barges. To minimize impacts on aquatic ecosystems, mining operations may rely on watershed functions to control erosion and flooding.

Surface mining inevitably has impacts as vegetation is cleared for mine development, topsoil and overburden is removed, and haul roads and port facilities are constructed. Opening of access to remote areas for mining can also lead to illegal logging and forest degradation. In mountainous areas such as the HoB, poor erosion control can have serious impacts on freshwater ecosystems, and sediments carried downstream can cause problems for river transport. Mine tailings are often highly acidic and if not managed properly, these acids can leach into groundwater and pollute aquatic ecosystems. When hard rock in the HoB is mined for coal, chemicals are used to separate the coal from the 'gangue', or unwanted rock. Gold mining typically used mercury and cyanide in processing. If poorly managed, these highly toxic substances can impact aquatic life, fisheries and human health.

Natural capital on which mining sector depends[51]	Impacts of unsustainable practices on natural capital	Impacts of declining natural capital on the mining and other sectors
• Minerals • Ecological infrastructure/River transportation • Watershed functions	Clearance and degradation of natural forest, biodiversity loss, and carbon emissions; Degraded watershed functions (soil erosion), river pollution, and damage to aquatic ecosystems and biodiversity, river sedimentation.	River sedimentation due to erosion can restrict river barge transport, resulting in increased costs for dredging and cost of alternative infrastructure development; Pollution of waterways can affect water supply and fishery sector.

The mining sector externalizes many of these impacts, which are exacerbated in cases where responsible mining practices are not followed and local and provincial regulations are not enforced. Mining activities in some cases displace indigenous and other local communities, resulting in conflicts with mining companies over security and land rights. Finally, the influx of workers is associated with informal and sometimes illegal economic activities, increased risk of communicable diseases such as HIV/AIDS, and other health issues related to working conditions in the mining industry[55]. (See Chapter 2.4 regarding the costs of lost ecosystem services related to mining).

Local forest-based enterprises

For the purposes of this report, local forest-based enterprises are defined as small-scale enterprises dependent on natural forest ecosystems[57]. The sector includes the harvesting of non-timber forest products (NTFPs), such as fruits, nuts, wildlife meat, medicinal herbs, fuel wood, song birds, bezoar stones, etc. and agro-forestry, e.g. planting durian, honey, rattan and Gaharu, a resinous wood resulting from a fungal infection in the wood or roots of trees of the genus Aquilaria[58] (see also Part V: Chapter 5.1 Green Economy solutions, Building a biodiversity-based sector, Community Gaharu inoculation and cultivation).

The mosaic of traditional land use systems in the HoB includes swidden agriculture, mixed fruit orchards, agro-forestry and woodlots. Villagers in Borneo's forests use the areas immediately adjacent to their villages for agro-forestry purposes. The radius around the village within walking distance (approximately 5-30 km) is used for NFTPs[59]. Traditionally, Dayaks harvest fruit, honey and resins without cutting down or damaging the trees. During the course of their long association with the forest, local communities have learned to utilize its products while managing it sustainably[60 61].

Few companies or enterprises within this sector are formally established. Given that the amounts used for subsistence also go unreported in trade statistics and in national accounts, a complete picture of the sector's contribution to GDP (or employment figures) cannot be drawn. Nevertheless, these activities are immensely valuable to local communities for subsistence, additional cash income and for local enterprises. As an example of the economic value the sector can have

Natural capital on which local forest-based enterprises sector depends[56]	Impacts of unsustainable practices on natural capital	Impacts of declining natural capital on the local forest-based sector and other sectors
• NTFP supply (e.g. fruits, nuts, wildlife meat, wild cinnamon, medicinal herbs, firewood) • Agro-forestry products (e.g. planting durian, honey, rattan, gaharu) • Watershed services • Soil structure • Decomposition of organic matter • Nutrient cycling.	Unsustainable extraction depletes supply for short-term gains; Unsustainable practices can degrade watershed functions (soil erosion, river sedimentation) and can result in biodiversity loss.	Forest degradation and forest conversion by *other sectors* reduces available products and local income.

for a village, Table 2.1 below estimates the monetary value of forest-based enterprises in Desa Ampa, a village of 40 households in Central Kalimantan.

Many other studies have highlighted the value of NTFPs as a source of income from the forests[63 64 65 66]. According to one study, the net annual income from the collection of NTFPs from primary forests in East Kalimantan is approximately US$46/ha. From a short-term economic perspective, this may not be the most economically competitive land use. However, when the financial value of ecosystem services such as watershed protection, erosion control and biodiversity conservation are included, the conservation of forest becomes economically viable from a national and regional perspective[67].

Local forest-based enterprises also provide significant nutritional value to communities. Studies have shown that people in villages with continuing traditions of forest product collection suffer lower levels of malnutrition than those in villages focusing on intensive rice cultivation[68]. Finally, for the Dayak, the sector has important cultural value.

Table 2.1: Economic value of non-timber forest products in Desa Ampa Village (40 households), Barito Timur District, Kalimantan (2011)[62]

Source of income	Quantity and frequency	Price in IRD (US$)	Income/ household	Income/village/year in IRD (US$)
Honey	2 harvests @ 30 liter	50.000/liter (5.45/liter)	3,000,000	120,000,000 (13,086)
Resin (Damar)	200 kg/month	12.000/kg (1.30/kg)	240,000	9,600,000 (1,046)
Rubber	15 kg/month	14.000/kg (32,715. 38/kg)	210,000	8,400,000 (916)
Eaglewood (Gaharu)	+/- IDR. 15 million/ year	300 million/kg (5.45/kg)	1,250,000	50,000,000 (5,452)
Total			4,700,000	138,000,000 (15,049)

Clearly, local forest-based enterprises depend on healthy forests. The rapid rate of deforestation and land conversion in many parts of Borneo threaten many of the traditional land use systems, while putting at risk indigenous knowledge of edible and medicinal plants and animals[69]. The impacts of deforestation, overharvesting and other unsustainable practices can be felt primarily in the decline of biodiversity, and in the incomes and livelihoods of local communities. Dewi et al. (2005)[70] have estimated that land use change and associated forest loss in rural areas of East Kalimantan have resulted in agroforestry and NTFP losses of US$9.9 to 19.4 million per year.

Logging, land clearing and other sources of encroachment on the forest have negative impacts on NTFP availability and production. A case study in Malinau, East Kalimantan, found that unsustainable logging was destructive to many categories of local forest product. Loss of the understory affected the availability of medicinal plants, materials for baskets and cord, as well as game animals. After logging, access to the area was impeded by debris and thorny re-growth. High-value trees within logging concessions, such as gaharu, became vulnerable to destructive harvesting by outsiders[71]. Finally, bearded pig and commercially valuable fish species declined in abundance, and local people believe that the value of the forest as a subsistence and economic safety net decreased as a result of logging[72].

The sector itself also has localized issues related to declining sustainability associated with demographic pressures and increased market integration of local communities. In addition, due to the prices that can be obtained for certain NTFPs (Gaharu, rattans, etc.), 'outsiders' now invade the lands claimed by local communities to collect NTFPs, causing some of these species to be reduced locally both in distribution and abundance[73]. As a result, some communities plant trees that produce dammar, a soft living resin useful in various products; in addition, Gaharu agro-forestry gardens are sometimes planted in order to be able to manage the resource sustainably on a commercial basis.

Freshwater fisheries

Historically, the river systems of the HoB have supported healthy fish populations that have been important for local communities. The Dayak have been practicing sustainable fisheries for centuries. They have many different traditional methods of fishing depending on their natural environment, including (fully biodegradable) poison[75], rods, seine[76], spears, and fish traps. Records from central and west Kalimantan state that Dayaks had developed a system of fisheries management that prohibited indiscriminate fishing methods as early as the 19th century. The use of a specific poison, which was found to kill all fish indiscriminately when poured on the surface of the water, was discontinued in 1926 along with the use of stationary fish traps in rivers which did not allow juvenile fish to escape[77].


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As with local forest-based industries, the contribution of local freshwater fisheries is difficult to measure, due to the substantial proportion used for subsistence, informal trading and barter. Consequently, a complete picture of its economic contribution cannot easily be drawn. However, the local population in the HoB clearly depends on fisheries for a large portion of the protein in their diets. Given that the road network in most of these rural areas is largely absent, waterways are important for transport, domestic water use, and as a source of nutrition[78]. Freshwater fisheries provide value both due to their role as a source of protein as well as by providing a ready supply of ornamental fish for sale[79]. In addition to the cultural value of aquatic systems and their

Natural capital on which freshwater fishery sector depends[74]	Impacts of unsustainable practices on natural capital	Impacts of declining natural capital on freshwater fisheries and other sectors
• Viable freshwater fish population • Healthy aquatic ecosystems • Fish nursery habitats • Hydrological services	Illegal fishing techniques, over-harvesting and unsustainable aquaculture lead to a decrease in aquatic resources, disturbance of food chain, increased nutrients in waterways and water supply conflicts.	Upstream poor ecosystem management and forest clearing, water pollution by palm oil, mining and other sectors and affects freshwater aquatic ecosystems and fishery viability.

significance for subsistence, some villages earn income from traded fish. Besides freshwater catch, some species are bred in floating cages, and others are potential candidates for aquaculture, considering their market potential and biology[80].

Ornamental fish such as the Arowana (*Schleropages formosus*) are exported from the HoB and contribute significantly to the monetary income of rural communities. Harvesting of Arowana in the Empangau Lake in Kapuas Hulu, West Kalimantan, between 2004 and 2009 generated an income of US$92,000 from the sale of 192 fish[81]. Arowana in particular is well known as some varieties of the species are on the IUCN Red List of endangered species and international trade is restricted. However, there are also many ornamental fish with stable populations, such as the Clown loach[82], and others such as Toman (giant snakehead fish) for consumption, which fetch good market prices for export. Finally, prawn nurseries in the area are of growing importance to the local economy[83].

To illustrate the pressure on aquatic resources, in one of the most valuable freshwater fish habitats, in West Kalimantan, the Danau Sentarum National Park wetlands, fishery yields are steadily decreasing. Interviews with local informants revealed that between 1999 and 2006 catches fell by approximately 40 per cent compared to the 1990-1999 period. Aside from natural cycles, suspected causes include the use of inappropriate fishing gear, aquaculture of the Toman, and habitat destruction. Several high-value fish, such as Asbelida (*Chitalahypselonotus*), Arowana (*Schleropages formosus*) and Patik (*Hemibagrusolyroides*) reproduce among the roots of swamp trees and are negatively impacted by upstream forest clearing[84].

In Sabah, landings from inland fisheries are declining due to habitat destruction from logging activities, pollution from agricultural plantations, illegal fishing techniques and over-fishing. Between 1990 and 1998, there was a gradual increase in landings from 1,200 tonnes to 1,700 tonnes. However, 1999 saw a steep drop in recorded landings to 89.58 tonnes. Figures on the number of fishing boats in Sabah's rivers between 1990 and 2003 are not available as many boats are not licensed. In May 2003, the State introduced the Sabah Inland Fisheries and Aquaculture Enactment to provide for the sustainable development and management of inland fisheries and aquaculture in Sabah[85].

Finally, climate change is expected to have slight negative impacts on the sector, as many fish species are highly temperature sensitive[86].

Fisheries are dependent on the rivers, streams, lakes and swamps as aquatic habitat and nursery areas. Habitat destruction from logging and other land conversion is the main factor taking its toll on fish populations and in some cases resulting in local extinction. Local surveys show the need to control sedimentation in some areas of the HoB, as it is considered a major threat to fisheries and aquaculture development[87]. The decline in stocks influences species biodiversity, with resulting impacts on fishery productivity[88]. Aquatic species are furthermore sensitive to temperature changes and changes in the BOD (biological oxygen demand) of a water body and may locally experience impacts from effluent from palm oil estates[89].

Hydropower


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Depletion of fossil fuels and increasing concerns about climate change have increased the urgency of a shift to renewable energy sources. Oil and gas production in Malaysia are expected to decline by 1 to 2 per cent per year on average in the coming decade[91]. Meanwhile, power demand in the BIMP-EAGA (Brunei Darussalam, Indonesia, Malaysia and the Philippines East ASEAN Growth Area) region is expected to increase by 2.7 times from 41,179 megawatts (MW) in 2007 to 126,288 MW in 2025; these regions are also exploring the potential to interconnect power systems between countries, in order to facilitate economic use of energy resources for mutual benefit, enhance power system security and create opportunities for energy trading[92]. Hydropower is often promoted as an alternative and relatively inexpensive renewable energy source.

The construction of hydropower dams requires sufficient water flow and suitable topography for infrastructure development. Due to its mountainous landscape and its role as the source of many rivers—including the headwaters of 14 of Borneo's 20 major rivers—the HoB provides ample opportunity for hydropower development. The viability and long-term sustainability of a hydropower dam is heavily dependent on minimization of sediment loading to the reservoir, which is supported by management of surrounding land use. Forests in water catchment areas of hydropower dams can contribute to sediment retention, and the hydropower sector is reliant on ecosystem services provided by forested areas in the HoB, particularly near the headwaters of the rivers.

On the other hand, large dams disrupt the flows and connectivity of river systems, cause a significant loss of biodiversity and habitats, disrupt the migratory routes of fish and may create social problems related to forced relocation and loss of livelihood of people living upstream of the dam. Hydropower facilities can also have a significant impact on water resources downstream of the dam, affecting activities that rely on these resources, such as fisheries, river transport

Natural capital on which hydropower sector depends[90]	Impacts of unsustainable practices on natural capital	Impacts of declining natural capital on hydropower and other sectors
• Water supply • Watershed functions.	Large dams disrupt flow and connectivity of river systems; Impacts on water resources downstream; Biodiversity loss and carbon emissions from newly formed reservoir.	Increased sediment loading into reservoir due to deforestation Reduction in operation life of dam and increased maintenance cost; Reduced water supply can affect production capacity; Increased sedimentation and reduced water supply can also impact drinking water supply and fishery sector.

and potable water supply. Since large hydropower dams are associated with social and environmental impacts, their development requires careful and responsible planning, sustainable practices and avoidance of high-impact areas. In 1981, the government of Sarawak, with the assistance of the German government through GTZ technical cooperation, conducted studies on hydropower potential in the state and identified 55 potential sites for hydroelectric power development. Sarawak plans to develop 12 new hydropower dams by the year 2020[93] to meet the state's industrialization needs. These dams are not only intended as a renewable energy source but also as a significant driver of economic development in the state. They are expected to meet electricity demand from different actors, including households, energy-intensive industries and power exports, e.g. to BIMP-EAGA countries.

Bakun Dam, with a capacity of 2400 MW, was completed in 2011 and has not been free from social and environmental impact-related challenges. As a turning point, the new developer for Murum Dam (projected to supply 900 MW), Sarawak Energy Berhad (SEB), is putting in place responsible practices in its development of hydroelectric power. As SEB is a member of the International Hydropower Association (IHA), it has a commitment to implement the IHA Protocol to ensure that sustainability principles are adhered to during development and operation of the Murum Dam.

There are some successful examples of micro-hydro developments in the HoB, e.g. several in Sarawak by PACOS Trust and in Kalimantan by community-based organizations. These provide enough power (around 8 KW[94]) for the needs of local communities (see also Part V: Chapter 5.1 Green Economy solutions, Innovative green sectors: Micro-hydro). Finally, the future of hydropower may be affected by a changing climate, as increased precipitation is expected in most of Borneo. Even though it is not possible to predict with certainty the magnitude of projected impacts, it is expected that hydropower potential will increase[95].

Tourism

The HoB's extraordinary ecosystems draw visitors from around the world, and several areas within the region have great potential for development as ecotourism destinations. Nature-based tourism in the HoB has grown significantly, particularly in Sabah and Sarawak, providing local and national economic benefits. Sabah is an especially popular ecotourism destination, and tourism already contributes more than 10 per cent of GDP. In the HoB, the tourism sector is dependent on the forest, 'landscape beauty' and biodiversity to provide attractions, as well as the communities of forest dwellers themselves, whose lifestyle and cultural heritage constitute a significant attraction for tourists.

Arrivals to Sabah have more than doubled between 2002 and 2010, and further increases are expected over the coming decade, with the government targeting nearly twice the number of visitors by 2020[97]. Conservation fees in Sabah were MYR 11.96 million (US$3.7 million) in 2008, of which MYR 4.65 million (US$1.4 million) was derived from park entrance fees[98]. Sabah serves as a good example of how tourism can help to finance conservation activities, with the state government regulating and supporting tourism development.


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Sarawak has not experienced as rapid tourism development as Sabah. Sarawak received 3.27 million visitors in 2010, 1.69 million of whom were tourists. The tourism-related income of Sarawak is estimated at RM 3.8bn (US$1.4 million) (Ministry of Tourism, Sarawak, 2011). There is still large untapped potential for growth in this sector in Brunei and Indonesia. Efforts to establish community-based ecotourism operations can be found across the HoB, while annual arrivals continue to increase. The sector is growing and significant increases in revenue could be realized. Even in relatively remote areas of West Kalimantan, a steady rise in tourism can be discerned, despite the impact of global economic uncertainty.

Growth in tourism will involve increased air and road traffic and will require related infrastructure development. Visitors also generate waste and increase local demand for food, water, electricity and other services. As such, tourism is driven by the attractiveness of ecosystems and biodiversity; it relies on, but can also have impacts on, local ecosystem services such as water supply and water purification. Besides the increased pressure on natural resources and ecosystem services, tourism can have socio-economic impacts, including increased income disparity, influx of migrant workers and loss of cultural heritage[99].

The economic returns from exploitation of landscape beauty and cultural values of the HoB for ecotourism purposes often accrue to investors outside of the HoB, while relatively little is retained at local level. The same applies to the control of tourism business by local people. In effect, local people run the risk of being reduced to the role of labourers for outsiders who derive most of the profit from their social and natural resources[100].

With careful planning, cooperation and dialogue among multiple actors, tourism can be a vehicle for equitable and sustainable development. In the case of the HoB, tourism should also contribute to conservation; otherwise, the sector may not be sustainable, given the extent to which it depends on maintaining environmental quality.

Natural capital on which tourism sector depends[96]	Impacts of unsustainable practices on natural capital	Impacts of declining natural capital on the tourism sector
• Biodiversity • Water purification • Attractive 'viewscapes'.	Impacts of increased infrastructure, including roads and airports can results environmental impacts and loss of biodiversity.	Declining landscape beauty and loss of biodiversity reduces attractiveness to tourists; Loss in biodiversity reduces opportunity for local livelihoods from ecotourism.

2.4 IMPACTS AND COSTS OF LOST ECOSYSTEM SERVICES

What's in this chapter

- Quantitative impacts and costs associated with lost ecosystem services
- Key services being impacted are water resource availability, water quality, sedimentation, flood control and air quality (due to fire and haze)
- The actual and potential severity of economic impacts associated with declining ecosystem services

The previous chapter has described the sometimes complex relationship between different sectors of the economy and natural capital and the effects on people's well-being. An important, though unfortunate, aspect of this relationship has been the negative impacts of economic growth on HoB's natural capital and declining ecosystem services. For example, the case of logging illustrated how over-extraction can provide short-term profits while causing production and profits to decrease in the long term. In addition to resource depletion, unsustainable extraction has impacts on the capacity of an ecosystem to provide services such as maintaining the hydrological cycle, preventing soil erosion and river sedimentation.

This chapter focuses on impacts and costs due to reduced or lost ecosystem services. It describes a range of negative impacts on ecosystem services, including reduced water availability, declining water quality, river sedimentation, flooding, and related negative impacts of land conversion such as haze and fire. As discussed in the previous chapter, there is not a 1:1 relationship between damages and sectors; instead, many of the costs / damages described below emanate from the cumulative impacts of multiple sectors. The impacts described below will only worsen if the HoB's ecosystems and biodiversity continue to degrade. As ecosystem services become impaired, costs to businesses, governments and individuals will increase. Finally, it should be noted that the figures presented here are partial and preliminary and should serve as a basis for further refinement.

Changing water resource availability

HoB ecosystems are an important source of downstream water supply through replenishment of groundwater and surface water bodies to towns and cities as well as for industrial activities. An important and related ecosystem service consists of regulating the availability and timing of water supplies downstream.

The impact of deforestation on annual and seasonal water yield is the subject of ongoing research and debate. In general, studies suggest that deforestation leads to an increase in total annual water yield downstream; this is because natural, intact forests consume more water through evapotranspiration than most other land uses. However, deforestation and soil compaction can cause significant changes in seasonal water availability and decreased groundwater recharge, resulting in a decreased base flow in the dry season.

Households are experiencing water shortages and being forced to acquire water from costly alternative sources.

Deforestation and forest degradation in upper and midstream ecosystems in the HoB have already begun to affect seasonal water availability for downstream population centres and industrial activities. Households are experiencing water shortages and are being forced to acquire water from costly alternative sources (see Box 2.2). Local examples include a water utility in Sanggau (West Kalimantan) which had two of its water springs (Bron Engkayas and Bron Ensilup) dry up in the dry season due to expansion of palm oil plantations[101]. In the dry season, water utilities in Banjarmasin (South Kalimantan) and Pontianak regularly implement rotational distribution, whereby access to water is rotated among the various areas to which water is distributed, restricting access to specific timeslots during the day.

At the moment, no real costs are being expended by water utilities in order to ensure a reliable water supply. Although modeling results are not available to provide further insight into the causes of a decline in base flow, it is possible to estimate the cost to society. For the three main river basins of Kalimantan, the cost of building reservoirs to create a water buffer is estimated at US$10 million (see Box 2.2).

Local inhabitants are impacted most by a potential decline in water availability, as they face price increases of 50 per cent to purchase water from private vendors in the dry season. As a result, an average family needs to spend US$30 per month, or about one third of its monthly income, to purchase clean water in case of water shortages.

Box 2.2: Estimated cost of decline in water flow during the dry season

Value of water supply from HoB for water utilities and those connected to water distribution network

Water utilities in Kalimantan have noticed a declining base flow of the river during the three driest months of the year. This results in water shortages. Inhabitants that are not connected to the piped water distribution network are facing price hikes by vendors during the dry season. An analysis using InVEST found that a large proportion of water in three of Kalimantan's major river basins originates in the HoB – 55 per cent for the Mahakam, 40 per cent for the Kapuas Barito, and almost 60 per cent for the Kapuas. A change in land use in HoB consequently changes the hydrograph of these rivers, resulting in decreasing water availability downstream during the dry season.

Several water utilities are already being forced to ration water during the dry season. To prevent this, companies must either find alternative sources of water or create a reservoir for freshwater storage. Water utilities in these three river basins supply 180 million m^3/year of water to meet current demand.

Water utilities and inhabitants would face substantial costs in the event of even a five per cent shortage in water supplies during the dry season. Shortages of this scale would require freshwater storage capacity of 2.3 million m^3 simply to meet current water demand. The cost of constructing a reservoir to meet this demand is estimated at US$ 5 per m^3 or over US$10 million altogether. This figure does not account for the additional costs of land acquisition, operation (pumping costs) and maintenance or the construction of pipelines and pumping stations to connect the reservoir to the distribution network.

Value of water supply from HoB for inhabitants that are not connected to water distribution network

Only 50 per cent of Kalimantan's inhabitants are connected to a water distribution network. The other 50 per cent extract water from wells, surface water or buy water from vendors. If wells and surface water become unreliable sources, they will have to resort to water from vendors and water delivered in trucks. Private water vendors sell water at IDR 300,000/ m^3, but prices often increase by 50 per cent in times of shortage, up to 450,000 IDR/ m^3 (US$50/$m^3$). If 5 per cent of the inhabitants that do not have a house connection have to purchase water for consumption and cooking (15 l per inhabitant/day) through a private vendor in the dry season, this would lead to a total additional cost of US$3.9 million/year, to be borne by individuals. For one affected family, this would mean an additional household expenditure of US$30/month during the dry season; this is a substantial sum, given that the average income in Kalimantan is around US$100/month[102].

As the two examples above indicate, both water utilities and individuals have a clear financial interest in maintaining hydrological functions within the HoB landscape.

Impacts on water quality

Borneo's main cities are located along rivers and near the coast. Households and industries such as fisheries are dependent on the quality of water in these rivers. Due to low discharges in the dry season, salt water is penetrating further inland during high tide and affecting the quality of water supply. Saltwater intrusion is a serious problem in the cities of Pontianak (West Kalimantan) and Banjarmasin (South Kalimantan). Groundwater in the coastal lowlands is usually brackish; in Kalimantan, it also contains high levels of iron, which make it unsuitable as a source of drinking water.

In order to meet World Health Organization (WHO) drinking water quality standards, water utilities in Borneo are exploring various options for securing water supplies, including dam construction, freshwater reservoirs and searching for alternative, inland water sources. However, none of these options is cheap, and all have negative externalities associated with them. Box 2.3 below illustrates the situation in Pontianak, where the cost of obtaining water from an intake 25 km upstream is estimated at US$2 million per year.

Increased soil erosion results in transport of nutrient-rich litter and topsoil in overland flows to streams. The consequences are many, including eutrophication of streams, which may affect species diversity in the river systems. The extensive use of fertilizer and pesticides by palm oil and agriculture plantations has additional water quality impacts. Some of these plantations use agrochemicals excessively or improperly dump POME into rivers and streams (see above Chapter 2.3, section on palm oil cultivation, for more details). Fertilizers can be removed by water treatment companies through the use of sand filters and /or biological treatment. Pesticides are much more difficult to remove, however, requiring complex and expensive treatment systems using membranes, oxidation or active coal.

Another water quality issue related to deforestation is a high pH level. This may occur when forests are cleared and groundwater tables are deliberately lowered in order to convert peatland into agricultural land.

Finally, serious pollution (e.g. mercury, manganese, cyanide, acidic waters) can result from mining activities undertaken without proper chemical and wastewater treatment.

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Declining seasonal flows in the Kapuas and Landak Rivers result in increased saltwater intrusion, with significant impacts on drinking water quality.

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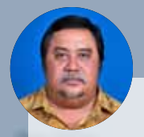
IMPACTS OF MINING ON WATER QUALITY
Sumadi, 45, Desa Harowu-District, Gunung Mas, Central Kalimantan, Indonesia:
"Most of the villagers are now engaged in gold mining for a livelihood: mining has thoroughly contaminated the river and destroyed its quality as well as caused damages everywhere. As for the impacts, most of the rivers in which mining occurs can no longer provide other benefits, such as fish and drinking water for the community. This situation was very different 15 years ago, when there was no mining. We were able to catch fish easily. We could even see fish from the surface of the river. Children could swim along the river at that time. I often drunk the water directly from the river. Now, no one dares to drink the water from the river, because of health impacts. Oh, how I wish we could bring the past back with us to the present time."



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IMPACTS OF PALM OIL EXPANSION ON WATER QUALITY AND SUPPLY
Lukas Subardi, Director of Sanggau, local-government-owned drinking water utility, West Kalimantan, Indonesia:
Lukas is concerned by the rapid expansion of palm oil plantations in West Kalimantan: "In the dry season, all of the smaller rivers are dry due to the endless deforestation of the Kapuas natural forest… in the rainy season, the river water is very turbid and heavily polluted by waste from leaching chemicals such as herbicides, pesticides, industrial waste, sludge, silt, etc… all due to expansion of oil palm upstream." (Lukas's blog is at http://pdamsanggaukapuas.blogspot.com/)

To increase the capacity of water distribution in the dry season, the city of Pontianak in West Kalimantan is constructing a second pipeline to extract water from further upstream at an additional cost of over US$10 million.

Box 2.3: Costs of water supply for the city of Pontianak, West Kalimantan[103]

During the dry season (July-October), discharge of the rivers Kapuas and Landak to the sea decreases, leading to saltwater intrusion during high tide. As a result, salinity in the rivers increasingly affects the quality of the water intake for the city of Pontianak. If the salinity of the intake water rises above 600 mg/l, the water utility (PDAM Kota Pontianak) pumps backup water from Penepat, 25 km away from Pontianak, resulting in increased operational costs due to fuel consumption by the pumps.

Current costs - In 2009, Pontianak's water utility spent US$140,000 to pump 2.2 million m^3 of water from the intake 25 km upstream of the city of Pontianak. To increase the capacity of water intake from Penepat during the dry season, the Public Works Department has already begun construction of a second pipe from Penepat to Pontianak. This pipeline will have a capacity of 500 l/s and is estimated to cost over US$10 million.

In the dry season, when Pontianak relies completely on Penepat for its water intake, the production capacity is insufficient to meet the city's demand of 1080 l/s. As a consequence, the water utility needs to ration water supply by supplying parts of the city only during certain hours of the day. When the Penepat pipeline is not operational because of mechanical problems or lack of fuel (which is the case about 70 per cent of the time), the water supply is completely cut off and customers have to collect drinking water from distribution reservoirs.

Future costs - At the moment, 68 per cent of Pontianak's inhabitants are connected to the distribution network. The city plans to expand connectivity to 80 per cent in the near future. Under this scenario, and assuming 80 per cent operational time and full capacity intake from Penepat during the dry season, the total cost for pumping the required water to the city would increase to US$2 million/year. In case of extreme drought events like in 1997[104] and 2002, the cost would exceed US$2.5 million/year.

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Impacts of sedimentation on river transport

Soil erosion is a significant problem in environments with high rainfall intensity. Forest soils are normally protected by the canopy and stabilized by roots and leaf litter. Following logging, repeated disturbance of the soil by burning, frequent weeding or overgrazing, the surface of the soil often forms a compacted crust, preventing infiltration and increasing surface runoff and soil erosion.

River sedimentation occurs when erosion upstream leads to higher sediment loads in rivers and deposition of sediment downstream. The process occurs naturally and river deltas are formed by sediment deposition, but land use changes upstream may lead to large increases in the amount of sediment entering a river system, causing significant problems for the more heavily populated floodplains. The HoB's mountainous landscape is vulnerable to erosion, and the problem will only worsen if HoB's forested ecosystems are not managed sustainably.

Mountainous landscapes with steep slopes are especially vulnerable to erosion following deforestation. Figure 2.8 below illustrates the physical vulnerability of the soils of Borneo[105]. The island's most erodible areas are primarily located within the HoB. Thus, deforestation and unsustainable practices in the HoB have disproportionate impacts on river basins throughout the island.

Forest sediments are rich in nutrients and can contribute to eutrophication in streams, with resulting impacts on aquatic species diversity. However, the most significant socio-economic impacts of increased river sedimentation in HoB have been borne by the river transport sector and those industries that depend upon it. Industries such as coal and timber use rivers to transport their products downstream to coastal cities, while household goods are typically shipped on barges to villages upriver.

Forest sediments are rich in nutrients and can contribute to eutrophication in streams and damage aquatic species diversity.

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The island's most erodible areas are located primarily within the HoB.

Deforestation and unsustainable practices in the HoB will have disproportionate impacts on river basins throughout the island.

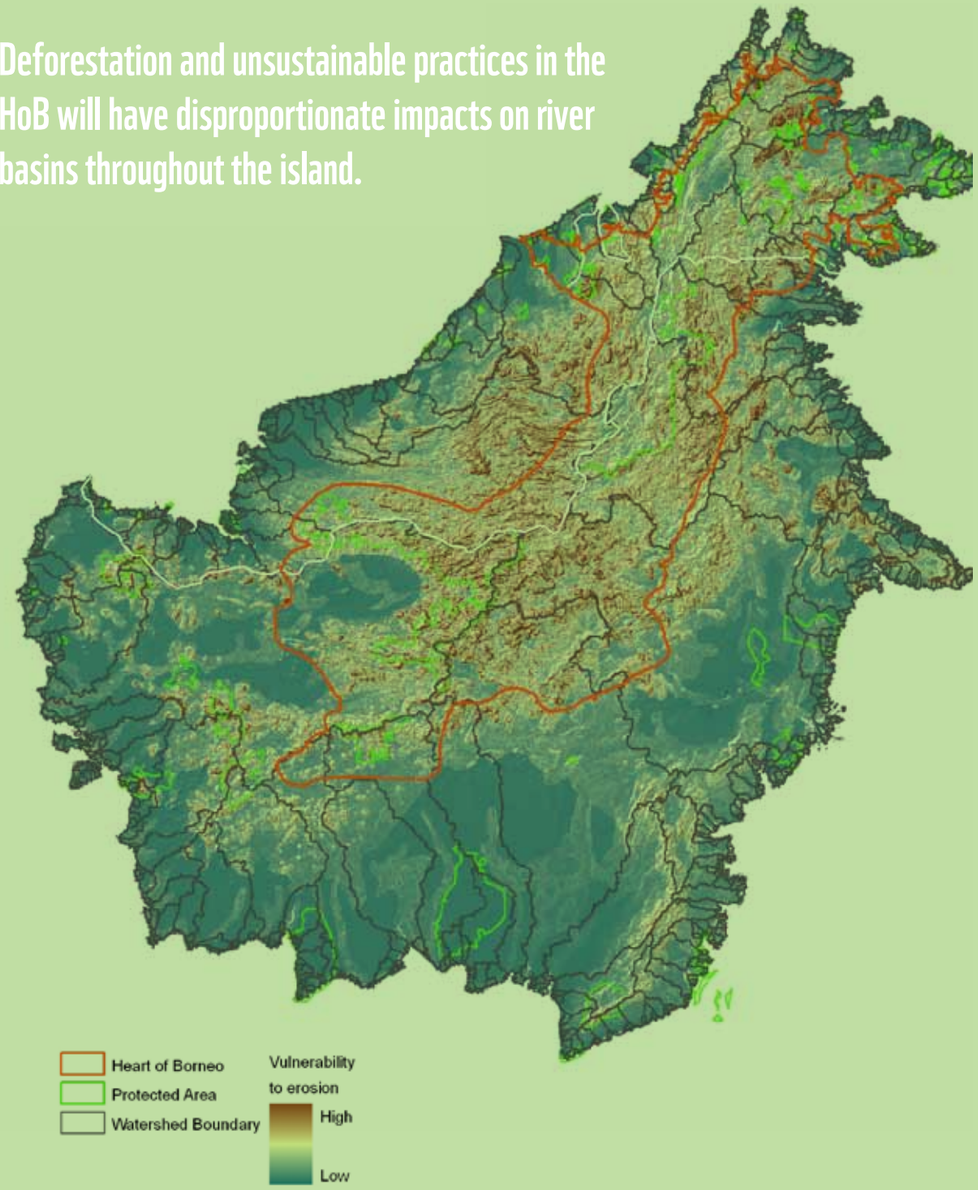

Figure 2.8: Physical vulnerability to erosion[106]

A number of coal mining companies in Central and South Kalimantan have confirmed that transport capacity, rather than production capacity, is the main factor limiting their production. For example, production by coal mining companies is limited by the fact that the upper reaches of the Barito River are not navigable during 40 per cent of the year. Turnover could increase by US$100 million/year in that region if river transport were possible year round (see Box 2.4).

The sea channels for the ports of Pontianak and Banjarmasin require maintenance and report dredging costs of US$3 million and US$11 million respectively per year (see Box 2.4 for more detailed numbers on the Barito-Kapuas river basin). Barges are still the least expensive means of transport (see Figure 2.9). The increased cost of dredging rivers may ultimately encourage railway or road construction that would lead to further deforestation and forest degradation.

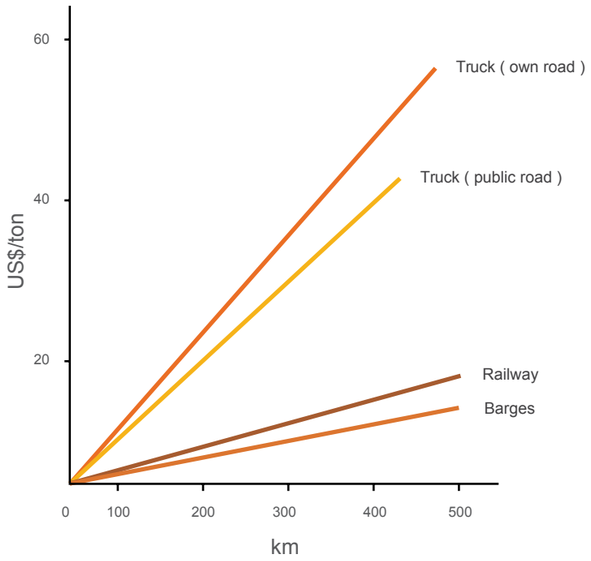

Figure 2.9: Estimated transport costs for mine produce in Kalimantan[107]

All major rivers in Kalimantan require regular dredging. No sediment transport models or time series data are available to help estimate natural sedimentation of these rivers or what percentage of the sedimentation may be anthropogenic, i.e., due to deforestation and land use change; nevertheless, deforestation is clearly an important contributor.

BHP has recorded on average 40 per cent of the year as non-barging days in the last 14 years.

Box 2.4: Barito-Kapuas river basin

Banjarmasin Port is Kalimantan's main port, serving many of the 2.6 million people in South Kalimantan and the 1.4 million people in Central Kalimantan. The port is located about 25 km upstream from the Barito River estuary, in the western region of South Kalimantan. Each year, approximately 250,000 twenty-foot equivalent unit (TEU) containers and 55 million tonnes of coal are transported through the access channel in the mouth of the Barito River estuary. The channel charges transport barges a fee of US$0,337 per million tonnes of coal.

Due to heavy siltation, more than 4.5 million m^3 of maintenance dredging is undertaken every year. In 2008, the access channel was realigned at a cost of US$44 million, dredging an additional six million m^3, but reducing the annual dredging requirement to two million m^3/year. It is estimated that the Barito River contributes some 30 per cent of the silt accumulating in the access channel. Much of the remainder consists of materials from the surrounding tidal flat that has been re-suspended by wave action. Considering this, around US$3 million can be allocated to sediment transport coming from the Barito River. Due to data limitations, it is not known how much can be allocated to deforestation in the river basin. In 2011 a large dredging program started in the rivers surrounding Banjarmasin, Kuin, Pelambuan and Kelayan, with costs budgeted at US$250,000. (http://sijaka.wordpress.com/2011/02/09/tiga-sungai-besar-ojek-pengerukan)

Further up the Barito River, transportation barges experience difficulty at both high and low water. During times of low water, coal barges must travel partially loaded or not at all; during high water, barges cannot pass under bridges. Over the last 14 years, the mining company BHP has recorded an average of 40 per cent of the year as non-barging days, which severely restricts the industry's total annual transport capacity. A number of coal mining companies in Central and South Kalimantan have confirmed that transport capacity, rather than production capacity, is their limiting factor.

According to the Indonesian Coal Book 2010-2011, three companies with a combined annual sale of six million tonnes/year transport coal along the upper reaches of the Barito River. With a current market price of US$50 per tonne of coal and assuming production capacity is sufficient, a 40 per cent limitation in transport capacity (instead of an average 20 per cent) implies a loss in turnover of US$100 million/year.

Impacts of floods

The relationship between deforestation / forest degradation and flooding is a subject of ongoing research. In general, undisturbed forest soil has sufficient infiltration capacity to easily absorb most rainfall intensities. Forest clearing, however, tends to disturb the soil and cause increased run-off during periods of intense rainfall. Especially after burning and land clearing, the use of heavy machinery can cause soil to become compacted and lead to increased surface run-off[108].

Studies on this subject have not yet been performed in the HoB. It is therefore unclear the extent to which deforestation and forest degradation may be contributing to the incidence and severity of downstream flooding. Based on historical data on the number of households and the area inundated during previous floods, an estimate of the yearly damage caused by floods for three key river basins is presented below.

KAPUAS RIVER BASIN

Several districts and cities in the Kapuas river basin have been identified as being at high risk of flooding. These high-risk zones have a resident population estimated at 1,395 households. Flood events occur frequently. On three occasions in 2010, parts of the city of Pontianak were flooded up to a depth of one meter. Each time, a different area was flooded. Assuming that each area has a flood event once a year and damage of two million IDR/household/per event, flood damage can be assessed at about US$300,000 per year

BARITO-KAPUAS RIVER BASIN

According to "Rancangan Pola Wilayah Sungai Barito-Kapuas"[109], nine locations have been identified as most prone to flooding and in need of integrated flood control measures. Flood-prone areas in the Barito-Kapuas River Basin are home to an estimated 13,318 households. Assuming one flood event/year, the yearly damage would cost approximately US$3 million.

Floods cause damages of more than US$12 million/year to households in the three major river basins of Kalimantan.


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MAHAKAM RIVER BASIN

Samarinda, the provincial capital of East Kalimantan, is located in a low-lying area and is crossed by tributaries of the Mahakam River. Flooding has become commonplace in Samarinda since coal mining activities began upstream and is thought to be linked to mining-related deforestation and impacts on soils. According to PSP-KT/Pusat Study Pembangunan Kalimantan Timur the three lakes in Mahakam river basin—Jempang, Semayang and Malintang—experience significant sedimentation. Thirty years ago, these lakes were 15 m deep and clear; today, they are only 2m depth and their water is murky. Sedimentation in the three lakes appears to be related to the floods in Samarinda. In 1998, nearly the entire city was inundated by four meter high floodwaters, and many lives were lost. During a six-month period between 2008 and 2009, major floods affecting over ten thousand families occurred four times, flooding streets to a depth of 1.5 meters and disrupting the economy, transportation, employment and livelihoods. Assuming that each flood event caused damage costing IDR two million (US$220) /house /event, the total estimated cost of these floods is IDR 80 million, or almost US$9 million over a six-month period. Income from coal mining constitutes only four per cent of the town's total regional revenue (IDR399 million, (US$37,000), out of a total IDR 112.5 billion (US$12.4 million), in 2008). The city is planning flood mitigation measures worth US$350 million for the coming 13 years[110]; the cost of flood prevention measures is thus far greater than its income from coal.

Udin, farmer from Nunukan, East Kalimantan, Indonesia:
"The shallow river can no longer retain heavy rainfall; it overflows and our fields are inundated with water. We have only managed to sell 20 per cent of the harvest. A loss of hundreds of millions of rupiahs for us farmers. There are also landslides, floods, houses destroyed and no electricity."

Impacts of fire and haze pollution

Deforestation and fire are closely linked in Borneo. Fire is a traditional tool for clearing land in some rural communities, but has more recently been used at large scales to convert forest to oil palm and timber plantations. Unplanned or out-of-control fires have destroyed large areas of natural forest. Economic losses from fires are substantial and have been estimated at between US$8.7 billion and 9.6 billion[111]. Another study calculated the damage from both the 1997 and 1998 fires to be approximately US$9.3 billion[112]. Forest and peat fires have made Indonesia the world's third largest greenhouse gas emitter, behind the United States and China. In 2000, 85 per cent of these emissions were estimated to result from land use change and forestry[113]. Peat lands in Kalimantan and other areas of Indonesia are rich in organic matter and become massive greenhouse gas emission sources when drained and the peat oxidizes. It has been estimated that approximately 600 million tonnes of CO_2/year are released from the decomposition of dry peat in Indonesia. At a price of US$10/metric tonne, average annual emissions from peat lands would be worth US$14 billion[114].

The haze pollution due to fires results in additional economic impacts. The 1997-1998 events resulted in severe productivity losses and schools and businesses were closed for weeks. Singapore suffered from lost tourism, flights were cancelled, ships and aircraft collided due to poor visibility[115]. The total damages directly resulting from haze were calculated at US$1,012 million for Indonesia, US$310 million for Malaysia, US$104 million for Singapore[116].

Another consequence of the 1997 forest fire was the loss of wild honey production, which resumed only in early 2000. Prior to the fire, the annual production of wild bee honey in the DSNP region of West Kalimantan was estimated at 20-25 tonnes per group of gatherers (averaging between 10 to 30 gatherers per group[117]) with an average price of IDR 15,000 (US$1-2) per kg. Consequently, the loss of honey production in 1998-1999 resulted in losses of US$67,000 to US$84,000 per group, not including other damages to ecosystems that are difficult to quantify[111].

In response to the 1997 fires, an ASEAN Ministerial Meeting adopted a Regional Haze Action Plan, which eventually led to the ASEAN Agreement on Transboundary Haze Pollution in 2000; the plan aimed to monitor and prevent forest fires. In Borneo the season when there is most risk of forest fire is June to October; during this period, forest fires are persisting[119].


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END NOTES PART II

[1] This figure, which is based on a diagram from the *UN System of Environmental-Economic Accounting (SEEA) – A framework for measuring interactions between the environment and the economy*, is an adaptation of how the relationship between economy and environment is usually depicted in Input-Output analysis. Input-Output analysis is a method which investigates the interdependencies between different sectors in the economy developed by Wassily Leontief. In 1973, Leontief received the Nobel Prize for Economics for his work on Input-Output analysis, which subsequently became the basis for the system of national accounts used today.

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PART III:
ENVISIONING AND MODELING THE GREEN ECONOMY

Part III:

Envisioning and Modeling the Green Economy

Overview

Part III presents an initial attempt to evaluate the contribution of natural capital to the society and economy of Borneo. It describes, and presents the findings of, a modeling exercise aimed at generating preliminary estimates of the economic value of natural resource stocks, ecosystem goods and ecosystem services and estimating how their conservation could contribute to continuing inclusive economic prosperity.

Chapter 3.1 presents a conceptual overview of the macroeconomic modeling work, including a view of a nature-economy system that values natural capital.

Chapter 3.2 describes the modeling approach and explains the framework of analysis and how the two scenarios—Business-as-Usual (BAU) and Green Economy (GE)—were developed. The analytical methods and modeling tools used for different aspects of the analysis are also presented here.

Chapter 3.3 presents the quantitative findings generated by modeling of the two scenarios. The chapter begins by presenting the simulation of changes in forest cover associated with both the BAU and GE scenarios. It goes on to describe the results of the integrated, cross-sector macro analysis, including impacts on growth and equity as well as investment findings. Finally, results from modeling the impacts of BAU and GE scenarios on natural capital are presented.

FIGURES

TABLES

BOXES

3.1 CONCEPTUAL OVERVIEW

What's in this chapter

- Problems with the current conceptual framework for calculating economic prosperity (GDP)
- Contribution of natural capital to economies
- A nature-economy system that values natural capital

Worldwide, as evidence of ecological damage and economic costs has mounted, interest in identifying alternatives to 'business-as-usual' has also increased. Moving towards a greener economy involves recognizing and investing in nature in order to reduce and avoid future environmental damage and increase benefits derived from natural capital. Implementing a green economy requires accounting for the contribution of nature to GDP and rethinking capital allocations, incentives, markets and development indicators.

The sought-after characteristics of an economy that fully values natural capital—what we refer to here as a 'green economy'—can be summarized as follows:

- It would increase human well-being and social equity while significantly reducing environmental risks and ecological scarcities;
- It would deliver inclusive growth while sustaining natural capital to provide for food, water, climate, soils and resource security;
- It would deliver on development priorities of local and national government for the benefit of society, particularly its most impoverished segments[1].

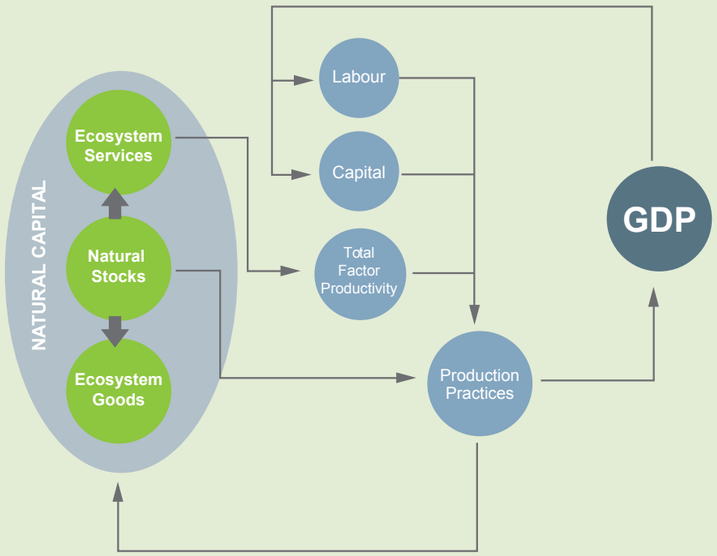
An economy that fully values natural capital would therefore be an engine of sustainable development. The green economy is an economic paradigm driving growth of income and jobs, while reducing environmental risks and scarcities. In addition, the developing notion of a green economy is one which also prioritizes increasing well-being and equitable distribution of the benefits of economic development or growth. Such an economy would sharply reduce or even reverse environmental damage, while mitigating climate change and aiding adaptation to it. It is an alternative economy, based on acknowledgement of the value of nature for people and incorporation of natural capital into economic policy and private sector decision making.

Transitioning to a green economy will take time and require the support of a range of key stakeholders. The initial modeling exercise described here represents an early step in this process—one designed to support HoB governments and stakeholders in identifying and quantifying the benefits of a pathway where natural capital is valued in economic decision making.

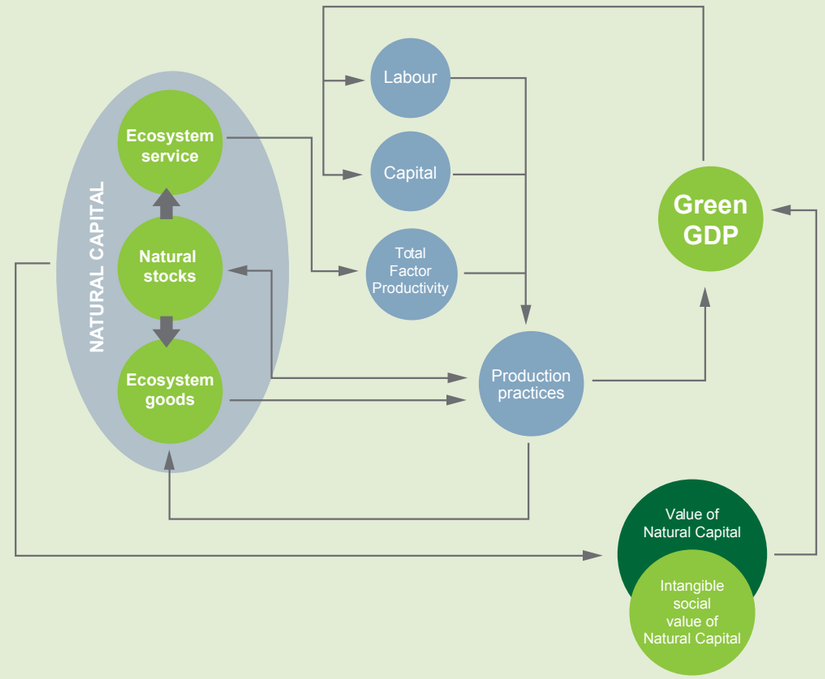
> By maintaining an economic system which structurally ignores essential functions of nature, we are destroying our own capacity to survive

An important starting point for modeling the green economy is to evaluate the current conceptual framework for calculating economic prosperity (GDP). Figure 3.1 below illustrates on the left hand side (a) the current situation. Here, economic growth strategies, as measured by GDP, fail to account for the essential contributions of biodiversity and ecosystems to economic growth and development. In conventional economics, only those natural resources that are 'visible' and 'tangible' are acknowledged as inputs into industrial production, e.g. trees for timber production, coal for energy production (Figure 3.1(a)), while the role of ecosystem services as production inputs and the critical need to sustain natural stocks to underpin long-term economic viability (such as sustainable forests for long-term timber production) remain largely unrecognized (Figure 3.1(b)).

As shown in Figure 3.1 (a), Gross Domestic Product (GDP), the most commonly used indicator for measuring national economic performance, remains largely disconnected from natural capital considerations and thus from the economic costs associated with depletion of natural resources and loss of essential ecosystem services. Excluding changes



(a)



(b)

Figure 3.1: (a) Conceptual model of the conventional economy which externalizes natural capital input to production (b) Conceptual overview of the nature-economy system in an economy that values natural capital (inspired by Bovarnick *et al.*, 2010[6])[7]

in the value of nature from GDP calculations therefore tends to encourage only those capital investments aimed at increasing production and profits in the short term, while exacerbating longer term processes of resource depletion and environmental degradation.

In Figure 3.1, production practices which generate GDP are understood to be a function of labour, capital (in terms of physical and financial assets) and Total Factor Productivity (TFP), which stands for contributions to productivity that are not directly related to financial capital or labor. This typically includes technology, efficiency, etc., and in our figure also includes those ecosystem services which have direct impacts on productive capacity.

The oval shows "natural capital", which encompasses the stock of natural resources, the goods they produce and the services they provide (also see conceptual representation of nature and economy in chapter 2.1)[2]. Natural stocks yield a flow of natural resources, e.g. the stock of forest yields a flow of cut timber and provides services in the form of regulating water flow. The stock of fish in a river yields a flow of caught fish and as a service maintains nutrient balance in the water through its role in the food chain. Natural stocks deplete as production increases. As a consequence, annual value added–GDP—increases while the value of the stock decreases. "Ecosystem services" therefore influence TFP by creating extra costs if natural stocks are not properly managed or by increasing productivity if they are managed well[3].

The crucial failure of conventional economic thinking to integrate fully natural capital into the analysis of production and GDP can be corrected through substitution of an alternative conceptual model which is illustrated on the right hand side (Figure 3.1 (b)). The revised model makes a simple correction to the valuation of production inputs by incorporating several fundamental natural stocks (biodiversity, forests, water, carbon and soil) along with the goods and services provided by ecosystems.

The oval showing 'Value of Natural Capital' in Figure 3.1 (b) includes the contribution of natural stocks to GDP other than just directly on production practices[4]. By taking into account the effects on natural capital of both production practices and GDP growth/decline, we arrive at a 'real' or green GDP. Mathematically, the 'Value of Natural Capital' represents the sum of the economic value of ecosystem goods (which are often part of the "informal economy" and do not show in the GDP figure) and the net annual change[5] in the value of natural stocks (including the ecosystem services they provide). A simple calculation showing the contribution of natural capital to the economy is presented in Box 3.1.

Implementing a green economy requires accounting for the contribution of nature to GDP and rethinking capital allocations, incentives, markets and development indicators

Deforestation and forest degradation create outflows as they decrease the total stock; examples of inflows are enhancing forests which increase total forest stock. Good management of ecosystem services creates inflows while deforestation and environmental degradation create outflows.

Three factors jointly define the transformation of natural capital into economic value added:

(i) Built-up (financial) capital, which accumulates through investments and declines with depreciation,
(ii) Labour, which follows demographic developments; being driven by the working age population, and;
(iii) Natural resource stocks, which accumulate with natural growth (when renewable) and when ecosystem services are well-managed, and decline with harvest or unsustainable extraction/practices.

Quantitative economic and environmental analysis of different future paths—green economy (GE) versus business as usual (BAU)—can aid decision making by offering a practical way to compare the likely costs, benefits and overall implications of a green economy approach. A first attempt has been made for Kalimantan, which covers approximately 72 per cent of the HoB.

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Stocks of natural capital and their in- and outflows are among the key long-term drivers of the economy in Borneo

Box 3.1: Cross-sector aggregate analysis, a simple example

Natural stocks: the physical stock of natural resources (e.g. forestland, measured in hectares (ha));

1. Example: 100 ha of forestland in 2011 and 90 ha in 2012

Ecosystem services: the services provided by nature (natural resources and ecosystems, e.g. watershed regulation from forestland, which possibly impacts GDP through TFP by preventing sedimentation that can restrict river transport);

2. Example: 100 per cent use of the river for transport in 2011, and 90 per cent use in 2012

Value of Ecosystem goods: the economic value of goods produced by the natural stock (e.g. NTFP, measure both with a physical or economic unit);

3. Example: 10 tonnes of NTFP in 2011 and 9 tonnes in 2012. The value, assuming US$50/tonne would be US$500 in 2011 and US$450 in 2012

Value of natural resource stocks: the economic value of all natural stocks (e.g. the economic value of the stock of forest, in US$/ha, or total US$);

4. Example, assuming US$100/ha of forest: US$10,000 in 2011 (US$100/ha * 100 ha) and US$9,000 in 2012 (US$100/ha * 90 ha)

Annual net contribution of nature (annual change in the value of natural capital): the sum of (1) the annual change in natural resource stocks (e.g. the net annual increase or decrease in the value of forest measured in US$/year, which is tightly coupled with the net increase or decrease of the natural stock); and (2) the value of ecosystem goods (measured in US$/year);

5. Example: (1) -US$1,000 between 2011 and 2012 (US$9,000 - US$10,000, see point 4); (2) US$450 in 2012 (see point 3). The total would be -US$550 in 2012, meaning that the value of nature has declined between 2011 and 2012. The value of timber production (positive) and the decline in river use (negative, see point 2), among others, in our study are already accounted for in the conventional GDP calculation

Green GDP: the sum of conventional GDP (which in our study already accounts for the economic impact of ecosystem services -also measured in US$/year-, through TFP) and the net contribution of nature (measured in US$/year).

6. Example: if conventional GDP is US$1 million in 2012, green GDP would be US$999, 450 (US$1 million - US$550)

3.2 OVERVIEW OF MODELING APPROACH

What's in this chapter

- Framework of the analysis
- Development of the Business-as-Usual (BAU) and Green Economy (GE) scenarios
- Analytical methods and modeling tools used for different aspects of the analysis
- Limitations

Previous attempts have been made to model green economies. For example, UNEP's *Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication* (2011) applies a macroeconomic model to explore the impacts of investing two per cent of global gross domestic product (GDP) annually in natural capital over the coming decades[8].

The present report builds on this approach and applies the resulting model to the HoB. While the HoB as a whole covers 22 million hectares, spread out over three countries (of which 16 million ha are in Indonesia), the modeling was only applied to Kalimantan's four provinces (which comprise 53 million out of Borneo's 74 million ha), with an emphasis on the value of the HoB. However, the results and the per capita value may be roughly applicable to Malaysia and Brunei, assuming that the contribution of nature (including ecosystem services) to economies is comparable across the HoB.

The key to improving the accuracy and contextual relevance of this modeling work is the participatory approach used to develop appropriate development scenarios and to define drivers and cause and effect relations. Outputs from proven approaches such as IDRISI Land Change Modeler and InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs) were used as inputs into the final integrated macroeconomic model.

The approach used reflects the fact that land use trends are tightly coupled with key social, economic and environmental drivers of Borneo's future, thus illustrating the important relationships among changes in land cover, gains/losses in ecosystem services and gains/losses in GDP—in short, the complex and interdependent relationship between nature and the economy.

Framework of the analysis

Green economy modeling is based on a framework of five dimensions of green growth (see Figure 3.2 below). These dimensions include elements of classical economic growth combined with values of ecosystems and equitable social development. Spatially explicit scenario assumptions are fed into the models (InVEST and System Dynamics) in order to estimate the difference between potential impacts of land use changes. These impacts represent the foundation on which two subsequent sets of estimates are constructed, namely: (i) the impacts of investments in natural capital conservation and the green economy, and (ii) the impacts of possible policy interventions and reforms (see Part IV).

To complete an assessment of natural capital for such a large and diverse area is challenging. As far as possible, the assessment is based on data sets that are complete, consistent, current and accurate. Due to limitations in the availability of data, BAU and GE Scenarios have been simulated for Kalimantan only. Published datasets were used wherever possible and third party data was reviewed to ensure its use was appropriate. Datasets and additional references used for the analysis are listed in Annexes III and IV and at www.hobgreeneconomy.org.

The remainder of this chapter describes the tools and the methodologies involved in developing and implementing the modeling exercise, as well as providing further information on the framework of the analysis.

The reliability of the modeling work was greatly enhanced by the use of a participatory approach in developing appropriate development scenarios, defining drivers and cause-effect relations and collating data input into model. Stakeholders provided input to explore the prospects of future development.

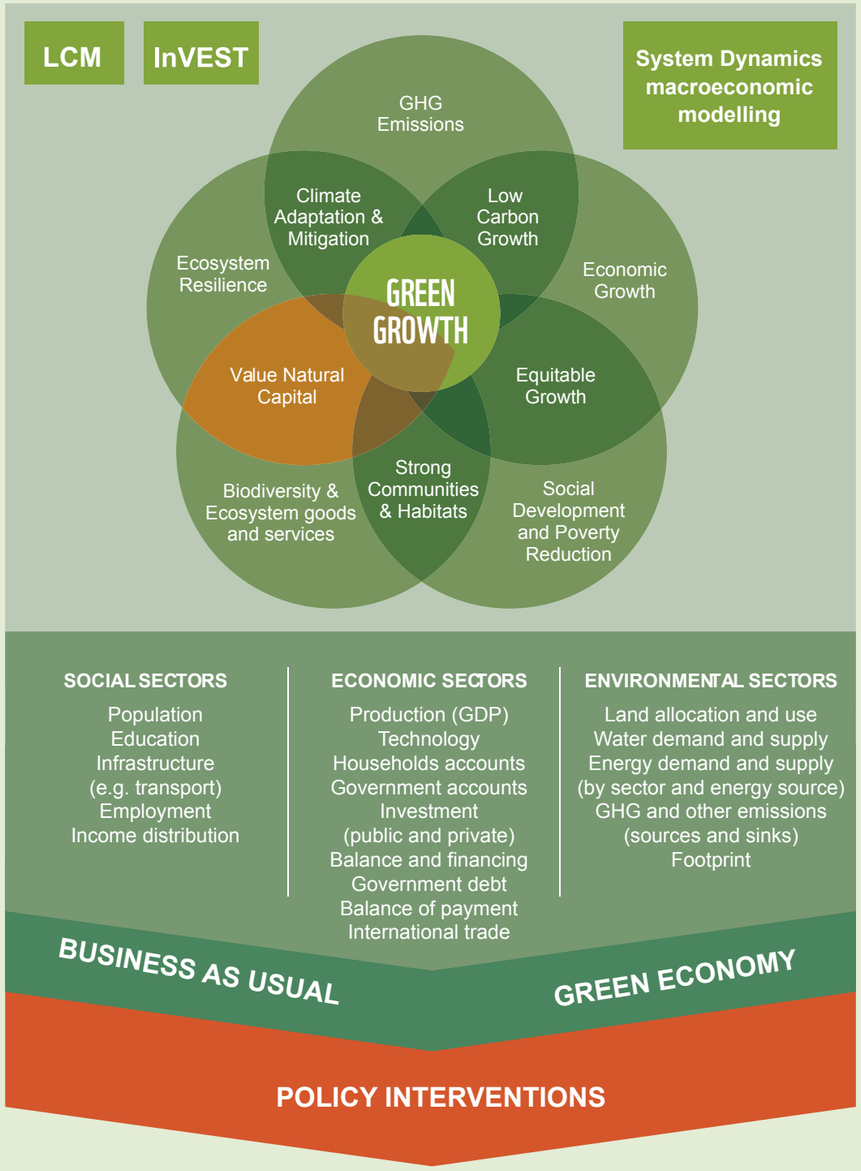


Figure 3.2: The three key layers of system dynamics integrated modeling: analysis, scenario and policy

Developing the scenarios

The first step in the modeling work consisted of the participatory development of scenarios, which began with a kick-off workshop[9] with government, business and development partners in December 2010. The group model building exercise conducted during that workshop forms the basis of the model used here to assess the impact of changes in the management of natural capital on economic development.

During 2011 and 2012, green economy dialogues were organized among civil society, experts, and Kalimantan government officials to increase understanding of, and mainstream issues related to, green economy, good governance and sustainable development.

More than 600 people in several districts in three provinces took part in the dialogues. Some of the issues discussed include:

- identification of alternatives for pro-poor and pro-green economies to provide input for the drafting of district government mid-term development plans;
- social and environmental safeguards and food security for future economic growth;
- fiscal incentives for green economy;
- communities' role in securing access, good governance and conservation of natural resources.

These dialogues also supported the formulation of scenarios for the modeling work and provided inspiration for the scenarios described in this study.

The scenarios which subsequently emerged were further developed based on a set of land cover and land use datasets that identified the areas and locations of permits for forestry, palm oil and mining development. The 'Business-as-Usual (BAU)' scenario is based on the assumption that forestry, palm oil developments and mining under these permits are all implemented[10] and that sustainable practices are not commonplace. This scenario also suggests forest degradation with active mining concessions and idle forest land, i.e. inactive concessions.

In the 'Green Economy (GE)' scenario, a series of changes are assumed to have been implemented. For example, palm oil development only takes place in areas that are not currently forested; certified palm oil and timber increases; idle forestry land is protected and/or restored; applications of fertilizers and pesticides are reduced; mining practices are aligned with the International Council on Metals and Minerals (ICMM) Good Practice Guidance for Mining and Biodiversity[11]; energy efficiency and investments in renewable energy are prioritized, biodiversity-based industries with added value generated in region are expanded, and; innovative business models which build local economies are put in place. The specific assumptions and policies used in the BAU and GE scenarios are presented below in Table 3.1.

Building and integrating the models

Three models were used to develop and analyze the impacts of the spatial development scenarios described above. The models are:

(i) IDRISI Land Change Modeler (LCM)[13];
(ii) Integrated Valuation of Ecosystem Services and Trade Offs (InVEST)[14]; and
(iii) a System Dynamics macroeconomic model based on Millennium Institute's T21[15] which is referred to here as 'the HoB modeling framework'.

The IDRISI Land Change Modeler (LCM) and standard GIS analysis techniques were used to convert the above-described scenarios and their specific assumptions into 'spatially-explicit scenarios', which map and quantify land cover in the BAU and GE scenarios[16]. LCM is a quantitative scenario generation modeling tool developed by Clark Labs that predicts land-cover change based on a range of variables including past land-cover change. LCM was used to develop the BAU and GE scenarios, based on land-cover changes observed in Kalimantan between 2000 and 2009. Because of the complexity of land cover change, modeling was limited to predicting change in natural forest extent. Biophysical and human drivers of land cover change were included in LCM modeling, including existing roads, fire distribution, slope, elevation and settlements. After completing the LCM modeling, scenarios were finalized using the most reliable land use information, such as concessions for mining, palm oil and forestry.

Land cover and land use maps were the main inputs used to assess the provision of ecosystem services using InVEST. Selected InVEST models were used to value and assess the impact of each scenario on several ecosystem services: water yield for water supply, water purification through nutrient retention, and sediment retention.

The InVEST Water Yield model estimates the relative contributions of water supply from different parts of a

Table 3.1 : Specific assumptions of the Business-as-Usual (BAU) and Green Economy (GE) scenarios[12]

Theme	Business as Usual (BAU)	Green Economy (GE)
Spatial planning	Limited enforcement or reconciliation of land use plans leads to deforestation and forest degradation	Coherent land use plans including the creation of a category for degraded land, expanding community forests and implementation of watershed protection
Protected areas	Poorly managed protected areas lead to loss of biodiversity and fragmentation of natural habitats	Effective protection of natural habitats with improved connectivity among protected areas
Forestry	Widespread conventional logging and plantation within High Conservation Value Forest (HCVF) Areas with inactive forestry concessions result in degradation due to lack of management	Reduced impact logging, international certification of sustainable forest management, plantations limited to highly degraded or deforested areas that are not HCVF Concession management is improved. Inactive forestry land is protected to reduce degradation. Forest restoration concessions are implemented within natural forest areas following logging
Palm oil plantation	Oil palm expansion is permitted in natural forest areas and HCVF No improvement in oil plantation management	Oil palm plantations do not expand in any area of natural forest. Land swaps for permits granted within natural forest, to ensure expansion on degraded land only Roundtable for Sustainable Palm Oil (RSPO) ensures that management practices are improved, including improved fertilizer and pesticide application management
Mining	Mining causes forest degradation within concessions and air and water pollution	Mining follows international good practice guidelines, with improved waste management treatment reducing impacts on air and water quality
Agriculture	No improvement in agricultural practices, increasing reliance on chemical fertilizers, use of monocultures results in greater vulnerability to pests and diseases	Sustainable agriculture practices maintain and restore soil quality, use of chemical fertilizers is reduced, larger biodiversity gene bank provides wild varieties that may be hybridized to ensure greater resilience to pest and diseases
Energy	Energy consumption grows, reducing exports and increasing the cost of energy use Power is mostly generated from coal and other fossil fuels, limiting exports and generating GHG emissions	Increased energy efficiency reduces domestic consumption (especially of fossil fuels), renewable energy use expands, costs and impacts of fossil fuel consumption are reduced Investments in non-hydro renewable energy power plants are implemented to decentralize power generation and to reduce consumption of coal for electricity supply and lower GHG emissions
Biodiversity-based enterprises	Limited infrastructure and support to advance biodiversity-based products such as NTFP and agro-forestry	Sustainable biodiversity products from legal community forests (NTFP and agro-forestry), bioprospecting and biotechnology supports soil quality, minimizes erosion and sedimentation and secures forest carbon by reducing pressure to convert forests
Innovative green sectors	Limited infrastructure and support to advance innovative green sectors	New business models build local economies, e.g. using 'waste products' from waste produced by current HoB industries

landscape, offering insight into how changes in land use patterns affect annual surface water yield. The InVEST Water Purification (Nutrient Retention) model estimates the contribution of vegetation and soil to purifying water through the removal of nutrient pollutants from runoff. The InVEST Sediment Retention model provides a tool for calculating the average annual soil loss from parts of the landscape, and to determine how much of that soil may arrive at a particular point of interest. It is possible to estimate the ability of each area to retain sediment, and to assess the cost of removing the accumulated sediment (e.g. through dredging) on an annual basis. The InVEST freshwater models are run for specific watersheds, and for the HoB a hierarchical catchment and river dataset was created for three major Kalimantan catchments – the Kapuas, Kapuas-Barito and Mahakam. This means that many sub-catchments are nested within the overall larger catchment. Using InVEST, parameters such as water yield, sediment export, and nutrient export were calculated on a sub-catchment and catchment basis. The InVEST models are well documented and have been applied in many regions around the world[17]. Published information was used for model calibration, for example, typical nutrient exports values per hectare for different land uses.

Finally, a macroeconomic system dynamics model was employed to finalize the overall modeling framework. In general, economic modeling simplifies complex economic processes, often using mathematical techniques. Linear models are often used to represent macroeconomic processes. The model used here is a simplification of a broader system, which encompasses both nature and economy (the "nature-economy system" conceptualized in Figure 2.1). It integrates sectoral knowledge within a single model using both economic and biophysical variables (e.g. forest is measured in hectares as well as in US$ (and/or local currency) and NTFPs are measured in kilograms as well as US$). Table 3.2 lists the main variables used in the mathematical equations underlying the model and assumptions regarding each of them.

Since the model aims to describe the complex interactions among economy, society and environment, it was necessary to apply *non-linear dynamics*, and to incorporate delays and feedbacks within and among sectors. Non-linear dynamics refers to the complexity of relationships among the components within a system. This complexity gives rise to tipping points and thresholds that are difficult to identify. For example, there is a tipping point after which more

Box 3.2: Tools used in the green economy modeling

IDRISI Land Change Modeler (LCM) and Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST)

Satellite imagery – Land cover and land use data represent fundamental sources of information for the above tools. Satellite earth observation provides the most cost effective, timely and accurate source. ESA's GlobCover provided time series land cover data, as did the Indonesian Ministry of Forestry. A biomass map from SARVISION derived using ALOS PALSAR data and a biomass map produced by Biotrop were also analyzed in relation to the global climate regulation benefits provided by the HoB.

LCM is a tool used to develop spatially-explicit and contrasting scenarios of future development—in this case GE and BAU scenarios. LCM allows prediction of future land cover based on historical, observed land cover change and other potential drivers of change. LCM provides tools to model land cover transition potentials that express the likelihood that land will transition in the future using, for the HoB analysis, logistic regression. LCM also allows maps of variables that might drive or explain change to be incorporated into the prediction model.

InVEST is a GIS toolbox that contains models to map the distribution of carbon stocks and sequestration, water yield, sediment export and retention, and nutrient (pollution) export and retention, and to assess how these could change under the spatially explicit and contrasting scenarios developed through LCM. Using GIS, it is possible to overlay the distribution of different services produced by InVEST to assess tradeoffs and synergies across these services under the two scenarios and identify areas where multiple services are provided. Such analyses help to target specific areas for implementing programs to maintain, restore and enhance the provision of ecosystem services. In combination, LCM and InVEST are useful GIS tools to develop scenarios and assess the impact of changes in ecosystem services under two contrasting futures.

System Dynamics (SD) Modeling for integrated cross sector analysis

The most important contribution of the SD model is its systemic structure that includes endogenous links within and across the economic, social, and environmental sectors through a variety of feedback loops. Most models focus on one or two sectors, but make exogenous assumptions about other sectors that affect and are affected by the sector under consideration. SD uses endogenous formulations instead. This improves consistency over time and across sectors, because changes in the main drivers of the system analyzed are reflected throughout the model and analysis through feedback loops. While detailed sectoral analysis is very important, it is not adequate to demonstrate the whole set of relations and feedback loops that properly represent the functioning of the real world and that have to be taken into account in making the necessary transitions to greener economic and social structures.

flood events can be observed, in relation to the expansion of timber production in a certain area. This is not a linear relation, as no impact may be visible for years, until several floods take place in a short period of time.

Delays constitute an important feature used in the model. Delays are time lags that influence several aspects of the system analyzed. Delays can be natural, e.g. the time it takes for a tree to grow up to a certain height or for biodiversity to return to a restored forest area, or may be related to built-up structures, e.g. the time it takes to build a hydropower plant or the lifetime of a tractor used for agriculture production.

Finally, of special importance to the model are feedbacks. *Feedback loops*, or feedbacks, include circular impacts that may trigger virtuous or vicious circles. For example, the higher the rate of deforestation, the lower the capacity of the ecological infrastructure to support productive activities, e.g. river transport affected by floods. With decreasing ecological infrastructure, investments are needed to increase physical infrastructure—such as roads—to sustain production, which further reduces ecological infrastructure and profitability. Without incorporating non-linearity, delays and feedback-loops into the model, it would be impossible to arrive at a realistic approximation of a system as complex as the "nature-economy system".

The macroeconomic System Dynamics model was customized from the existing T21 model. It is not spatially disaggregated and is focused on macroeconomic analysis. During the kick-off workshop, a Causal Loop Diagram (CLD), which forms the basis of the model, was developed through a participatory exercise. The CLD was further strengthened and calibrated using data from the LCM and InVEST analysis[18]. The CLD (see Box 3.3) represents a critical element of the cross-sectoral modeling, designed to identify and incorporate relevant feedback loops, as well as possible points for interventions. It is worth noting that the policy interventions, examples of which are shown in orange in the CLD, are related to the bottom layer of Figure 3.2. They point towards concrete strategic directions rather than providing input for intervention design, as the latter is beyond the scope of this study.

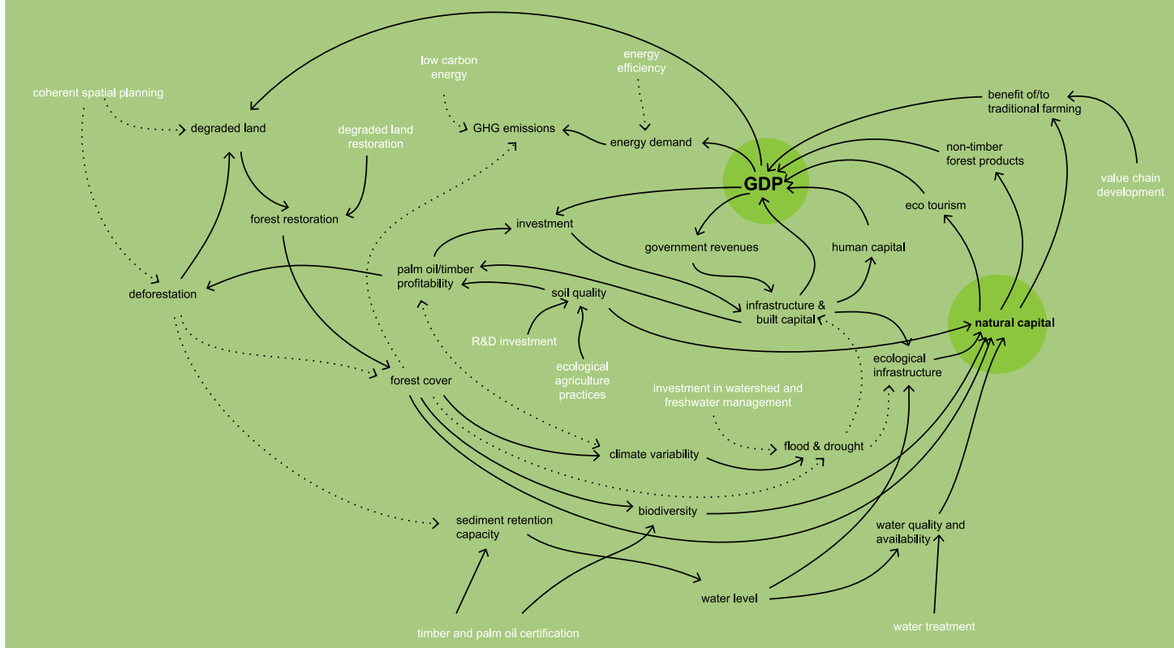
Used in combination, the above methods enabled the generation of broad, cross-sectoral spatial scenarios addressing environmental, economic, and social issues in a single coherent framework for analysis.

Each scenario generates projections for GDP and green GDP. The latter includes the net annual contribution of nature. This contribution is estimated using two of the three aggregate flows of environment-related economic values calculated in this study: (1) the annual change in natural stocks, and (2) the ecosystem goods generated annually such as NTFPs, which are often traded within the informal economy and not fully accounted for in the calculation of GDP[20]. The gain/loss of ecosystem services provided by natural capital was also calculated and assigned a value (such as ecological infrastructure, e.g. river use for coal and other transport). These are included in the calculation of conventional GDP as they directly affect productivity through impacts on production costs and, as a consequence, on profits and GDP. The first two flows are therefore the net value of nature not captured in the calculation of normal GDP. This process leads to an estimate of whether the value of natural capital (e.g. as standing forest and goods produced) increases or decreases on annual basis.

A central output of the scenario analysis is an estimate of the investment needed to support transformation from the current economy to a green economy that delivers conservation and sustainable development (excluding costs for building institutional capacity, adjusting administrative and accounting procedures, etc.). Combined with a preliminary policy analysis, this allows quantification of the potential impacts of policy implementation as they relate to relevant sectoral targets, e.g. GHG emission reduction, reduced deforestation, improved watershed/ freshwater management and expanding protected areas. The assessment accounts for both public and private investments and assumes that the total amount allocated to green development is effectively spent across sectors, through policy drivers, e.g. fiscal transfers, capital investment, regulated PES, mandates and targets. For this reason, references to investments refer to both public and private investment. Disaggregating public and private investment is important to estimate present costs and future benefits for the key stakeholders involved, both in economic terms and expressed as practices of conservation and sustainable management of natural stocks (as drivers for the provision of ecosystem goods and services).

More details on the models and their methodologies can be found in Annexes 3 and 4 as well as at www.hobgreeneconomy.org.

Box 3.3: Simplified Causal Loop Diagram (CLD) highlighting the main systemic relations between natural capital and key socio-economic and environmental variables on Borneo



Borneo's economy is driven by built capital, human capital and natural capital. These key variables, in turn, are driven by factors such as land use planning and land allocation (for timber, palm oil and mining concessions, etc.), energy and resource production and consumption, etc. A Causal Loop Diagram (CLD) was developed based on a participatory approach to identify relevant feedback loops, as well as entry points for interventions, e.g. expansion of palm oil on degraded land, ecological infrastructure, value chain development, investments in energy efficiency and renewable energy supply, etc. The loops, which were identified through a group model building exercise, are designed to reflect the main relations between natural capital and key socio-economic variables within and across sectors, indicating that land use trends are tightly coupled with other key social, economic and environmental drivers of Borneo's future. Stakeholders addressed a list of variables and indicated the positive and negative relations among these variables. Some of these relations can be verified by published literature, while others are based on empirical observations made by on-the-ground experts from Kalimantan. The CLD thus identifies the main systemic relations among natural capital, key socio-economic and environmental variables on Borneo.

Variables are related by causal links, indicated by lines with arrows. Each line starts at the independent variable and each arrow points at the dependent variable, indicating that the former is having an influence on the latter. That influence may be either positive or negative. A solid line indicates a positive influence: as the independent variable increases, the dependent variable also increases. A dashed line indicates a negative influence: as the independent variable increases, the dependent variable decreases.

Table 3.2 : Numerical and structural assumption used to calculate the value of natural capital[19]

Variable	Unit	Value	Reference
Natural stocks			
Carbon price	US$/tonne of CO_2	2 (and 15)	We analyze two scenarios, one with a low (US$2) carbon price and another with a price of US$15/tonne of CO_2. This is to illustrate the potential impact of carbon prices on the value of natural capital in Borneo. References include Venter et al. (2011) and McKinsey (2010).
Biodiversity value	US$/ha	27	The range of values found in the literature is as low as US$4.6 hectares per year (Pearce and Pearce 2001) to US$9,177 per hectare for pharmaceutically rich areas in Ecuador (Rauseer and Small 1998).
Forestland value (including primary and secondary forest, swamp forest, and mangrove forest)	US$/ha	US$900 over the past ten years, projected to double up to 2030 in the BAU case; three times higher by 2030 in the GE case	Estimated based on the weighted average potential profit from land use, including timber, palm oil or crop production. Palm oil and crop yield use local estimates, timber production uses global averages.
Agricultural and plantation soil value	US$/ha	US$13.5 on average between 2011 and 2030; rising trend over time	Estimated based on the projected differential in primary sector value added per ha (including agriculture, palm oil and forestry) caused by soil quality in the BAU vs. GE scenarios.
Ecosystem services			
Precipitation and flood events	Calibrated using historical data on precipitation and flood events. The key drivers of precipitation and flood/drought events are: a long-term precipitation trend including seasonal variations, an approximately 5-year random event for a large flood, and deforestation, influencing the frequency of floods.		
Road and river transport	Calibrated using precipitation and flood events historical data and communication with BHP Billiton on river use for productive operations. The main endogenous drivers affecting river use include: floods, also driving siltation, droughts, and water levels above and below levels of operations (driven by precipitation and siltation).		
Agriculture production	Calibrated using historical data, agriculture production is affected negatively by precipitation and water levels above and below optimal thresholds: high rainfall may lead to floods, which wash away topsoil, while droughts reduce seasonal yields.		
Ecosystem goods			
NTFP	US$/ha/Year	32	Van Beukering et al. 2009. Other estimates of the value of NFTP in Southeast Asia range from 8 to 55 US$ per hectare (Caldecott 1988; Mai et al. 1999).
Tourism	US$/ha/Year	27	The value of tourism is calculated by using the references on biodiversity, so that the total value of tourism and NTFP production adds up to US$60/ha per year, in line with the literature.
Other relevant assumptions			
Ecological agriculture cost	US$/ha	100	Baker et al. (2007), UNEP (2011). We assume a cost difference between organic and chemical fertilizers of US$680/ton or close to US$100/ha.
CO_2 Carbon Storage (forest)	tonnes of CO_2/ha	860	Koh et al. (2011)
Palm Oil palm oil FFB yield	tonne/ha	22 (forested area) 20 (degraded area)	McKinsey (2010) McKinsey (2010)
Palm Oil Average CPO extraction rate	Per cent	23 per cent	
Palm Oil Average KPO extraction rate	Per cent	5 per cent	McKinsey (2010)

Key limitations of the analysis

Models used in the assessment are simplifications of reality and there is uncertainty surrounding certain outputs. InVEST, for instance, is suited to identifying areas of relatively high and low ecosystem service provision, assessing tradeoffs, and exploring how levels of services and biodiversity may increase or decrease under alternative future scenarios. InVEST is able to provide coarse assessments of ecosystem services with relatively little data that can include readily available global or regional datasets, or look-up values from peer-reviewed and gray literature, but it offers low-precision estimates of ecosystem service provision[21]. InVEST produces a range of map outputs that can spatially reveal the most important sources of ecosystem service provision; however, not all of the maps produced from InVEST could be presented in this report. Selected outputs from InVEST provided some of the biophysical variables used in the system dynamics model.

Concerning the geographical coverage of the analysis, most of the work has been undertaken at the scale of four provinces in Kalimantan, with some of the elements being examined at smaller scales, e.g., catchment-level. Due to limited data availability and time constraints, Sabah, Sarawak and Brunei could not be included in the spatial and economic assessments. However, due to the relative homogeneity of HoB ecosystems and economic activity, the data used can in large part be assumed to represent the situation in all three countries.

Regarding the economic valuation of natural capital, alternative methods exist and, time and resources permitting, it would be interesting to see how these compare with the methods used, or how the various methods can complement each other. With the methods chosen, a representative selection of nature's goods and services has been valued for which data are available. Other financially measurable goods and services exist but in the short time frame of this assessment, not all have been assessed. These include for example the cost of haze pollution, an in-depth analysis of the ability of forest ecosystems to reduce vulnerability to climate variability, the contribution of biodiversity to the quality of ecosystem services, as well as the cultural values of forests. Therefore, more research should be done to expand the analysis presented here. This report is an initial step, but in order to analyze more fully the complex system being studied here, more systematic field research and data collection are required. HoB governments and international partners are hereby encouraged to coordinate and support these kinds of efforts.

Another important limitation of the analysis relates to the challenges of correctly representing and valuing an ecosystem. An economic valuation of parts of the ecosystem is presented here, along with an attempt to merge these parts within an integrated framework of analysis. However, the complexities of natural capital—as well as the complexity of its interactions with socio-economic development processes—add uncertainty to the exercise. Specific issues arising include the risk of double counting economic values and the challenge of fully incorporating the multiple roles of ecosystem services. On the other hand, even when running simplistic scenarios, insights emerge that an alternative economy is feasible.

Finally, given that this report compares two simplified scenarios, the analysis may not include all the likely land use changes in the area. Some of the omitted land uses could potentially have significant impacts on ecosystems and biodiversity. Both scenarios make use of current land use plans and permits and make simplified assumptions about land use management and enforcement. Neither scenario accounts for variations in the external drivers of land use change, such as variables influencing climate change, economic drivers relating to international prices, behavioural responses; neither have the importance of urban clusters been taken into account.

3.3 THE RESULTS

What's in this chapter

- Quantitative findings generated by modeling of the two scenarios
- Simulation of changes in forest cover associated with both the BAU and GE scenarios
- Results of the integrated, cross-sector macro analysis, including impacts on growth and equity as well as investment findings
- Results from modeling the impacts of BAU and GE scenarios on natural capital

Results of the modeling work are presented below in three sections:

- Simulation of change in forest cover under BAU and GE scenarios;
- Results from integrated, cross sector macro analysis;
- Results from modeling the impacts of BAU and GE scenarios on natural capital.

A final section summarizes results and identifies areas of future work.

Simulation of change in forest cover under BAU and GE scenarios

The BAU scenario for forest cover, based on IDRISI LCM modeling, projects a loss of 3.2 million ha of primary and secondary forest cover between 2009 and 2020, primarily due to palm oil expansion, mining and unsustainable forestry practices (Figure 3.4 below). Under the GE projection, the loss of forest cover is reduced dramatically, to 0.1 million ha. The difference in forest cover under the two contrasting scenarios is the foundation upon which further results—including quantified gains / losses of ecosystem services and the value of natural capital in the integrated cross sector analysis—are built.

Results from integrated cross-sector macro analysis

Impacts on growth

The ultimate result emerging from the analysis is that when considering multiple benefits of the green economy compared with the BAU, there are not only net biophysical benefits, but the transition within a social cost-benefit framework suggests that the benefits outweigh the costs. In contrast to a BAU scenario, in the long term, growth will increase more rapidly under a GE scenario where natural capital is sustained. Growth, under the GE scenario was assessed based on a conventional and a green calculation for GDP (Figure 3.3).

Our analysis shows that, under the GE scenario, both conventional and green GDP would grow as fast as, or faster (and more sustainably), than under BAU. Gains steadily increase under the GE scenario, while in the BAU scenario the rate of growth in GDP slows down more quickly in the medium and longer term. This is due to the simultaneous interaction of several factors under the GE scenario, including a potential slight reduction in profitability of the palm oil sector due to lower yields on degraded land, offset by improved ecosystems (leading to reduced costs for businesses, households and the government), larger revenues from NTFPs and tourism, higher crop yields and lower domestic energy (especially fossil fuel) consumption, allowing energy costs to decline below BAU and exports to increase beyond the base case. The creation of a biodiversity-based economy and the expansion of new green sectors also contribute to improved economic performance.

The fact that green GDP in the simulations grows faster and more sustainably than GDP in the medium and longer term is largely driven by two key results arising out of successfully sustaining HoB's natural capital:

(i) Avoided costs: reduced risk and damage from floods and droughts, resulting also in lower road and infrastructure disruption, higher river transport capacity and reduced siltation;

(ii) Added benefits: higher production of NTPFs, ecotourism, higher biodiversity, more carbon stored and enhanced ecosystem services.

The GE projections show higher GDP growth than BAU (up to 0.2 per cent of additional growth per year on average), a reduction in rural poverty (with 5 per cent higher per capita rural income by 2030, higher employment (especially in energy and agriculture), and a reduction in GHG emission intensity of about 30 per cent on average between 2009 and 2030 (including a reduction of 5 per cent in fossil fuel CO_2 emission intensity), with positive contributions provided by a biodiversity-based sector and by the effect of the expansion of new green sectors on all the above indicators. The fact that the carbon stock remains roughly consistent throughout the GE scenario is an important reason for these positive impacts. As previously noted, these results and the per capita values could also be applicable to Malaysia and Brunei, assuming the contribution of nature (including ecosystem services) is comparable.

Impacts on equity

Under the BAU scenario, rapid economic growth and short-term private profits are often directly or indirectly linked to public losses and loss of profit from other sectors which depend on biodiversity and functioning ecosystems. Depletion of natural stocks, and associated goods and services comes at a severe cost—one which is typically borne by public revenue and society as a whole. Poor forest management, clearing of valuable forested land for palm oil/agriculture/development and unsustainable mineral exploitation all leave governments and society to pay the price of water pollution, dredging of rivers, infrastructure repair due to flooding and loss of income due to degraded fisheries and forests.

In contrast, conservation and improved management of natural capital in the GE scenario reduces costs to governments and households (by avoiding the reduction in ecosystem services) and increases revenues of the rural population (by generating more ecosystem goods), thereby contributing to a more equitable future for Borneo.

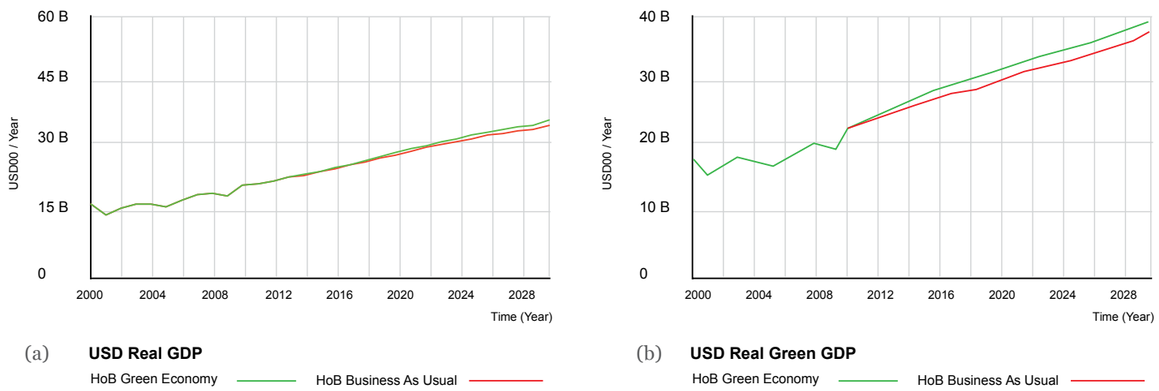
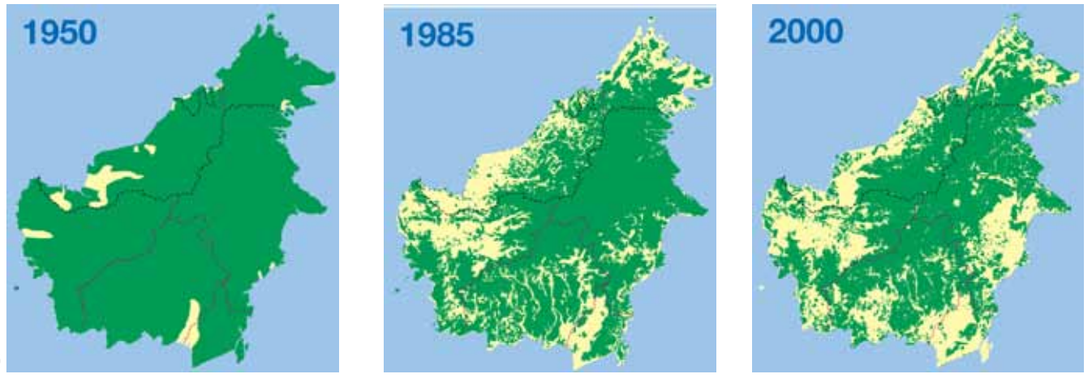
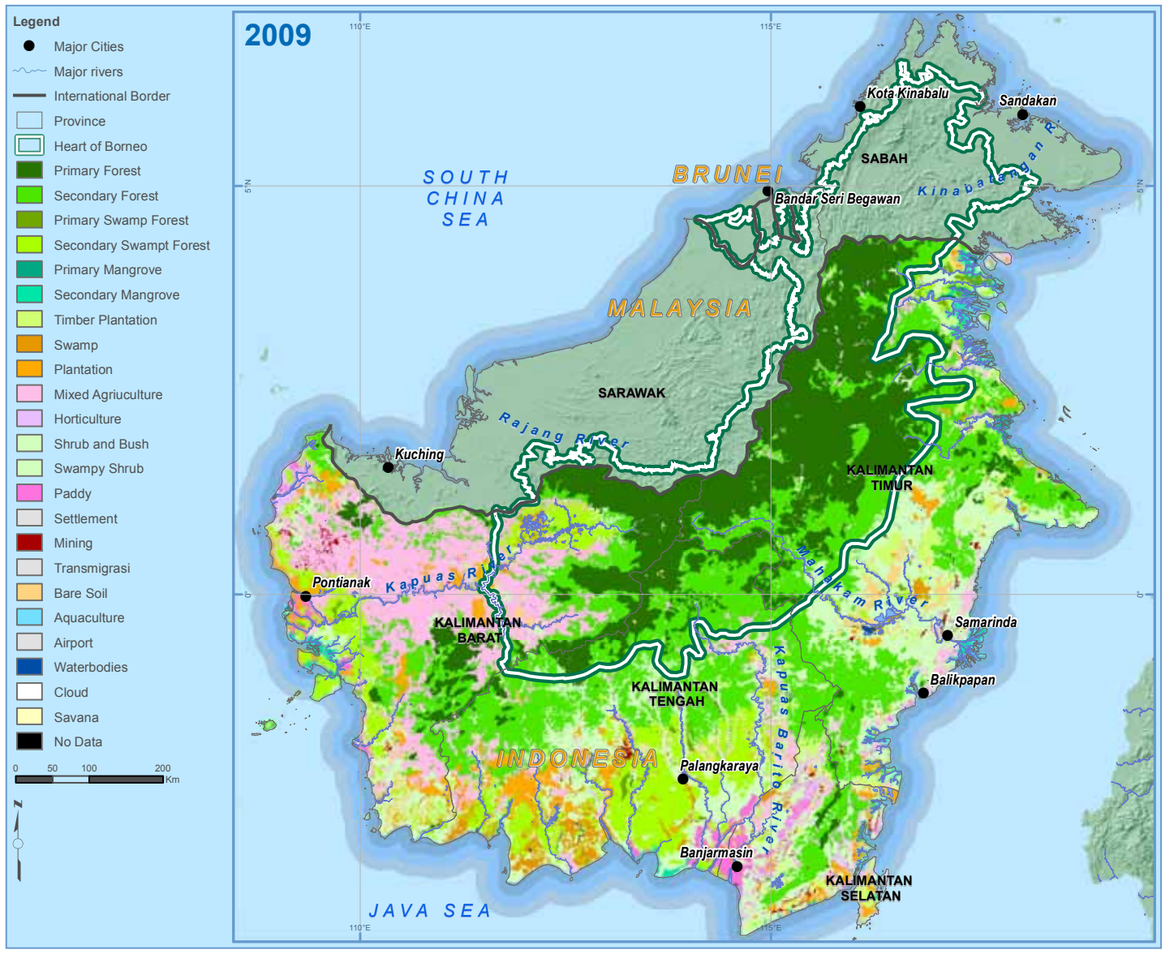


Figure 3.3: (a) GDP in different scenarios (b) Green GDP in different scenarios

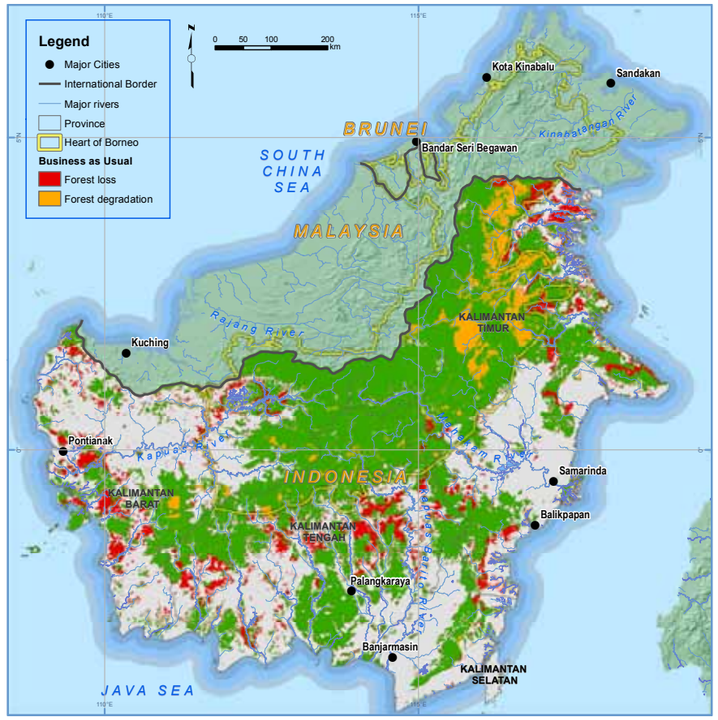
(a)





(b)

(c)



(d)

Figure 3.4: (a) Historic forest loss from 1950-2000; (b) land cover in 2009; (c) and (d) projected forest loss of 3.2 million ha based on BAU 2020 (top right) and 0.1 million ha based on GE 2020 (bottom right) scenarios

Investment findings

As far as investment requirements are concerned, in the green scenario these average 1.2 per cent of GDP between 2010 and 2030 (or 4.5 per cent in a high cost case)[22], with investments related to natural capital conservation requiring about 0.6 per cent of GDP on average in the average cost case and declining as progress is made. The investments simulated include a range of green economy interventions, such as regulated PES, including REDD+ payments, clear mandates on timber and palm oil certification, investments to promote ecological management practices and research and development and investments to reduce pressures on forest conversion and environmental degradation. Part IV and V provide a more detailed description of potential interventions suitable for the HoB. These are later referred to as policy interventions, on-the-ground solutions and cross-cutting solutions. Overall, the investment analysis allows comparison of the implications of costs on governments (in terms of deficit and debt) and on households (in terms of reduced consumption) and enables selection of the optimal allocation.

Net return on investment - The analysis of the return on investment shows the overall costs and benefits of transitioning to a greener economy for all the actors involved in the socio-economic development of Kalimantan and Borneo. A positive return on investment indicates that the benefits will outweigh the costs, but certain actors will turn out to be winners and others will be losers, unless coherent policies are implemented to support cost mitigation and the maximization of benefits.

The results of the integrated cross-sector modeling indicate that the net return on investment in the GE projection is sufficient to offset costs. In the short term, the GE projection shows costs and relatively few benefits; however, as time goes on, costs become lower while benefits increase. In other words, interventions aimed at sustaining HoB's biodiversity and ecosystems have costs in the short term and overall positive socio-economic and environmental consequences in the medium and longer term. The relatively long time it takes to break-even or to earn back GE investments suggests that the private sector will need incentives to begin making GE investments. This requires the government to carefully design medium- and longer-term strategies to provide an appropriate enabling environment.

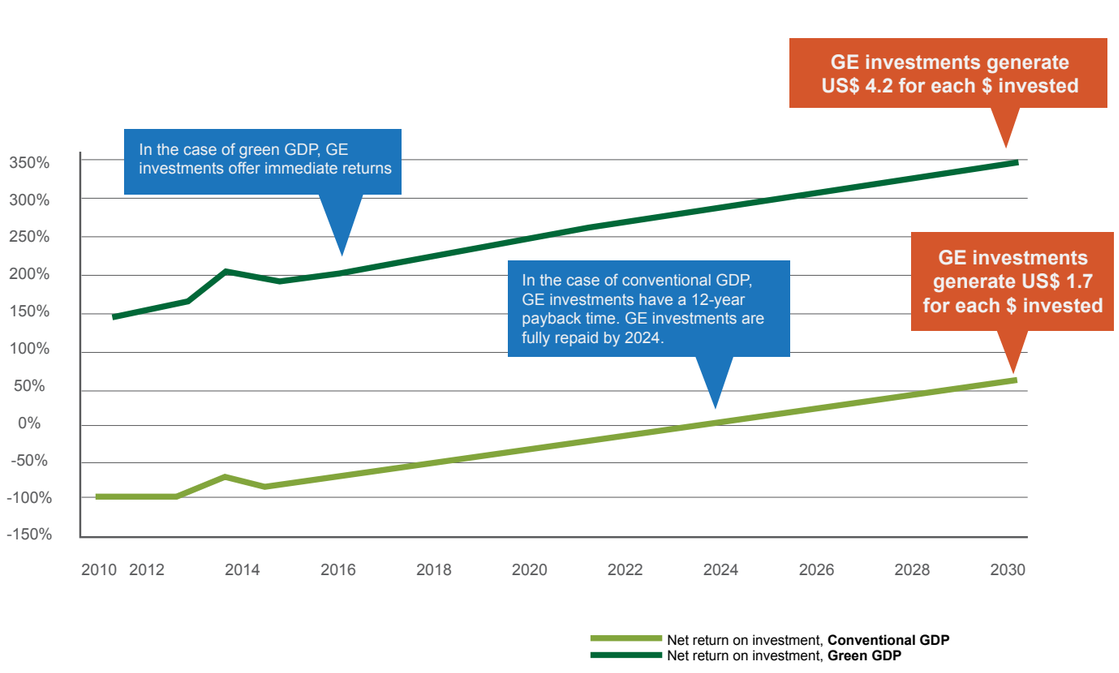


Figure 3.5: Net return on investment, under the GE scenario, comparing conventional and green GDP

To summarize the main results of the quantitative scenario analysis, as shown in Figure 3.5, measured according to conventional GDP, green economy investments by 2030 will generate US$1.7 for each US$ invested. At the outset there are only costs, which is why the return on investment starts at -100 per cent. Over time, as GDP grows, the net return on investment increases. The break even point (considering all investments) is 2024.

When measured according to green GDP, which includes the contribution of natural stocks to GDP and welfare and takes into account the effects of production practices and GDP on natural capital, GE investments by 2030 will generate US$4.2 for each US$ invested. The added benefit from nature and avoided costs from damaged ecosystem services, facilitated by GE investments, is 161 per cent higher than the investment itself. The return on investment is immediately positive[23].

Impacts on natural capital

As far as natural capital is concerned, the models indicate that each US$ invested would yield US$3.26 in natural capital value on average between 2011 and 2030. Under the BAU scenario, the total value of natural capital would increase an average of US$40 per capita annually between 2011 and 2020, but would decline by 2030, reaching a US$20 reduction per capita per year in 2050). In the GE scenario, under which an annual investment of 1.2 per cent of GDP is allocated to economic transformation, the total value of natural capital increases on average to US$90 per person each year between 2011 and 2030, with benefits especially in the short and medium term (Figure 3.6). Natural capital (stocks, ecosystem goods and services) is currently generating approximately US$60 per capita; in other words, natural capital is a source of revenue for the economy (private and public sector, as well as households).

On the other hand, if natural capital is managed according to the BAU scenario, its potential to generate revenue would decline year after year. By 2020, the environmental costs of economic growth would outweigh revenues from natural capital.

In fact, by 2030 the decline of natural capital—due to depletion of stocks, and consequent reductions in ecosystem goods and services—would cost Kalimantan's population up to US$10 per capita per year. Comparing the value for 2010 and the projections up to 2030, the difference between the two scenarios (the cost of inaction in BAU compared with the value generated under GE) would reach a maximum of US$70 per capita per year in 2030 (Figure 3.6). On average, this would represent a difference of US$25 per capita per year over the next 20 years[24]. In the GE scenario, conservation and sustainable management of natural capital leads to enhanced value of stocks, ecosystem goods and services, so that present and future generations accrue only net benefits.

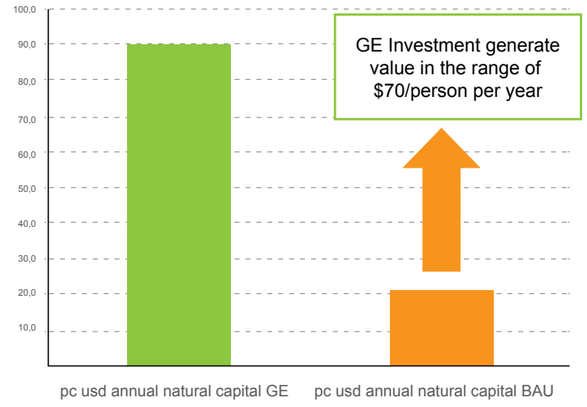


Figure 3.6: Per capita annual value of natural capital (US$/person, average 2012 – 2030)

Results from modeling the impacts of BAU and GE scenarios on natural capital

In addition to comparing GDP, natural capital and the overall value of ecosystem goods and services under the BAU and GE scenarios, modeling extended to more specific investigations of gains/ losses of selected ecosystem services and their associated values with dedicated calculations and case studies. This section reviews impacts in three areas: natural stocks, ecosystem goods and ecosystem services. It will describe results in two parts, the latter consisting of several sub-sections:

- Gain or loss of natural stocks
- Gain or loss of ecosystem goods, ecosystem services and avoided costs
  - Non timber forest products (NTFP)
  - Ecotourism
  - Carbon sequestration
  - Hydrological services
    - Water availability
    - Water quality
  - Effective ecological infrastructure
  - Reduced frequency of floods
- Soil services

Gain or loss of natural stocks

Key components of natural stocks that vary according to scenario include the following;

Biodiversity: Following projected trends in forest cover, biodiversity is projected to increase under the GE scenario, reversing the declining trend expected in the BAU case—a trend which is exacerbated by expected increases in average temperature in Borneo. Biodiversity is estimated to be worth on average US$800 million in the GE case, vs. US$600 million under BAU in 2030[25].

Forest: The value of forests is projected to increase over time under the GE scenario, especially when considering the potential land use options available—the analysis covers timber production, palm oil and agriculture as potential uses—as well as the many synergies created in terms of ecological infrastructure, e.g. river transport, and ecosystem services. Forests, from a purely economic, production-based perspective, are estimated to be worth US$110 billion between 2011 and 2030 on average in the GE scenario[26].

> There is an immense wealth of natural capital, which we could squander as we have in the recent past, or which we could "keep in the bank", conserved, and live off the "interest" which presents itself to us in the form of goods and services.

Carbon[27]: The assessment mainly considered primary and secondary forests and their essential function in storing carbon. The BAU trend in forest cover based on LCM modeling indicats a loss of 3.2 million ha of primary and secondary forest cover between 2009 and 2020. Assuming an average amount of 860 tonnes of CO_2 stored per hectare[28], it is estimated that 23.8 billion tonnes of CO_2 would be stored in biomass on average between 2011, 2020 and 2030 in the GE case, 22.6 billion tonnes by 2020 and 20 billion tonnes by 2030 in the BAU case. The economic value of this amount of stored carbon is estimated to average US$44.6 billion in BAU and US$47 billion in the GE case, assuming a conservative carbon price of US$2/tonne. The value of the stock increases to US$350 billion when the carbon price is set at US$15/tonne[29].

Agricultural Soil: Based on the value added of agriculture, palm oil and timber (plantation) production/ha, we estimate the economic value of soil quality to be worth on average over US$130 million in the GE scenario[30]. The value added of crop production currently averages US$55/tonne of production, or close to US$280/ha/year. While this agricultural and productive land is mostly outside of the HoB, the sustainable management of natural capital can help maintain productivity and generate value added well beyond the geographical boundaries of the HoB, with positive impacts decreasing with increasing distance from the HoB area.

Taken together, the above estimates lead to a total estimated monetary value for the 'stock of nature'—including the value of soil, forest, biodiversity and carbon storage—somewhere between US$11,000 and US$35,000 per capita (or, for instance, US$160 billion and US$485 billion for Kalimantan) in 2011[31]. While this value is projected to decline under BAU by anywhere from US$200-US$650 per capita per year, depending on carbon price assumptions, the trend is reversed under the GE scenario, which shows gains of US$50-US$110 per capita per year relative to BAU. This indicates that investing in natural capital now, while creating relevant synergies for socio-economic development and environmental conservation, would increase future revenue streams and support a more just and equitable economic transformation. Under the GE scenario, governments would be able to capitalize on a valuable opportunity once markets and mechanisms under development for the UNFCCC are established. Also under the GE scenario, Government revenues, in the case of conventional GDP, are projected to be US$100 million higher than under BAU each year between 2011 and 2030 and US$33 million above BAU each year between 2011 and 2020.

Based on specific assumptions used for estimating the economic value of natural capital[32], the contribution of nature to GDP could reach three per cent for the period 2010-2020. In addition, we estimate the overall value of natural capital to be between six and 16 times the value of annual GDP[33]. This means that there is an immense wealth of natural capital, which we could squander as we have in the recent past, or we could "keep it in the bank", conserved, and live off the "interest" which present itself to us in the form of the goods and services it provides.

Improved management of natural stocks under the GE scenario would also allow more value to be generated in terms of ecosystem goods and ecosystem services. The following sections analyze these synergies in more detail.

> A GE scenario secures future revenue. Under GE, HoB governments would be able to capitalize on a valuable opportunity once markets and mechanisms under development for the UNFCCC are established.

Gain or loss of ecosystem goods, ecosystem services and avoided costs

The choice of scenarios has significant impacts on generation and provision of the following:

Non-timber forest products (NTFP)

The modeling outcome suggests that, under the GE scenario, NTFP income for rural communities could increase by 25 per cent by 2030, reaching US$330 per person (in US$ 2000[35]) on average in Kalimantan, thereby contributing to an overall increase of per capita income to over US$1,000 in 2030 and to a reduction in income inequality. In spatial terms, the impact of NTFPs on income is expected to be stronger in the HoB or in proximity to the HoB area and weaker toward the coastline. In the BAU scenario up to 2030, income from NTFP remains similar to the current situation, oscillating around the same average value.

Ecotourism

Value added generated by the ecotourism sector could increase considerably over the next 20 years under the GE scenario as a result of improved infrastructure and environmental quality. On the other hand, it is difficult to estimate how quickly ecotourism could effectively increase, as the growth of the sector also depends on advertising, the service sector and various other factors. Based on a simple calculation, multiplying the primary and secondary forest area of Kalimantan by US$27 (see Table 3.2 for a more detailed list of assumptions), ecotourism could potentially generate up to US$900 million per year in the GE case, vs. US$750 million under the BAU scenario.

Carbon sequestration

The GE scenario results in additional carbon sequestration relative to BAU, sharply curbing the projected reduction in carbon stocks (Figure 3.7). Based on the projected forest cover loss of 3.2 million ha, the difference in carbon stocks between the BAU and GE scenarios is 1.2 billion tonnes of CO_2e, of which 23 per cent is contributed by land use change in the HoB. Assuming a carbon price in the range of US$2/ton and US$15/ton, the total value of projected reduction in carbon stock under the GE scenario would be between US$2.4 billion and US$18 billion.

Under the GE scenario, across Kalimantan's 158 timber concessions covering 13 million[36] hectares, a mean of ~19 (± 5) additional tonnes of carbon (tC) per hectare would

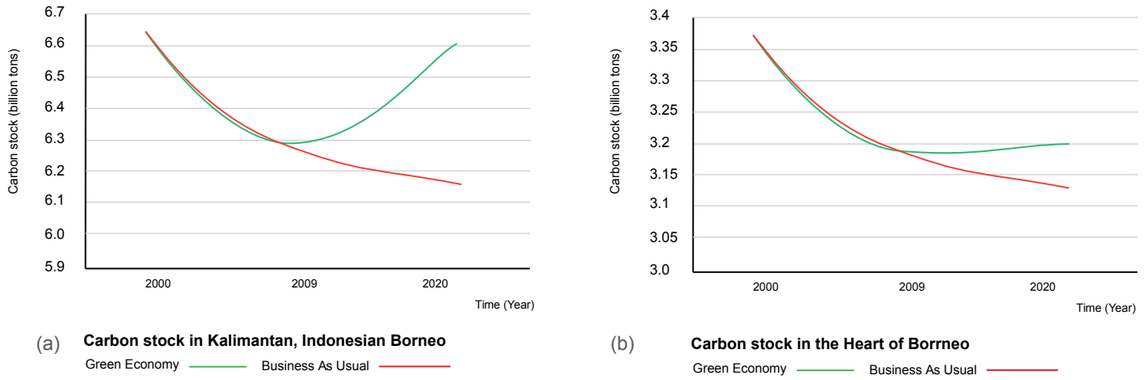


Figure 3.7: The difference in carbon stocks between the BAU and GE scenario is (a) 341 Mt (1.2 Bt CO_2e) in Kalimantan overall and (b) 80 Mt (292 Mt CO_2e) in the HoB

be stored compared to the BAU approach to concession management. The total additional carbon stored across all concessions under the GE scenario amounts to ~115 million tonnes of carbon[37].

In order to understand the potential costs and benefits of the GE approach, the study estimated the net social and market value of the potential additional carbon stored across the HoB timber concessions. The social value of carbon is a global value estimated by pooling together the costs borne by society to cope with the impacts of climate change. The social and market value of carbon were compared under two cost assumptions: 1) no net cost to improved management activities and 2) and a cost increase of ~30 per cent[38].

Figures 3.8 (a) and (b) show results of the potential value that improved techniques add to the social and financial bottom line of forestry concessions. Of course if there are no costs to improved management techniques in the green economy, then there can be financial gains for a concession assuming a functioning carbon market that credits carbon gained through improved forestry techniques, such as reduced impact logging (RIL). Under such an assumption, the green economy could potentially improve the financial bottom line. Across all concessions, the theoretical market value of the additional stored carbon would be greater than US$3.8 billion, (assuming a carbon price of US$9.2), with the largest individual concessions having additional carbon values over US$100 million (Figure 3.8a). If we look at

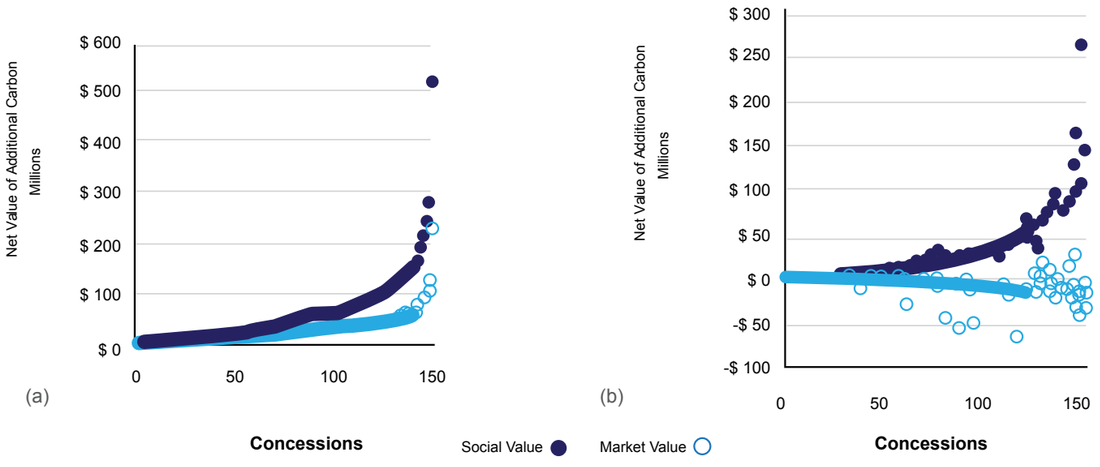


Figure 3.8: Net social and market value of the potential additional carbon stored in HoB forestry concessions under a green economy compared to BAU. Figure (a) assumes that GE techniques have no net cost and Figure (b) assumes an additional 30 per cent in management costs

the potential social value of the carbon[39], the returns to the green economy are close to US$9 billion, with the largest concession alone returning a social value of over US$500 million (Figure 3.8a).

Assuming an additional mean cost of US$790 per hectare to operationalize improved management techniques[40], the results are somewhat altered. Most concessions return positive gains when using the social value of carbon, and the total returns to the green economy under this assumption are over US$4 billion. However, compared with the market value only, the additional costs of management outweigh the potential financial returns for the majority of concessions (Figure 3.8b). However, the total cost is US$900 million under the assumption of a payment of US$9.20 per tonne of CO_2 (a recent European Trading Scheme price point for carbon). What is clear from this is that the improved management techniques (at least in terms of carbon) are favourable from a social cost-benefit perspective. Here they return a social cost-benefit ratio >4, meaning that the value of social benefits is over four times greater than the private costs of improved management.

Additionally, the mean break even price across the 158 concessions—at ~US$12 (±4.50)—is only slightly higher than the current market price for carbon. Under the assumption that a green economy with improved forestry practices entails a financial cost, a carbon value of ~US$12 would therefore be enough to offset it. Overall, as long as the market or social value of carbon is greater than ~US$12 (±4.50) per tonne of CO_2, then improved timber management techniques will simultaneously deliver net benefits.

GE scenario results in higher carbon stocks compared with BAU—curbing the projected reduction in carbon stocks.

Hydrological services

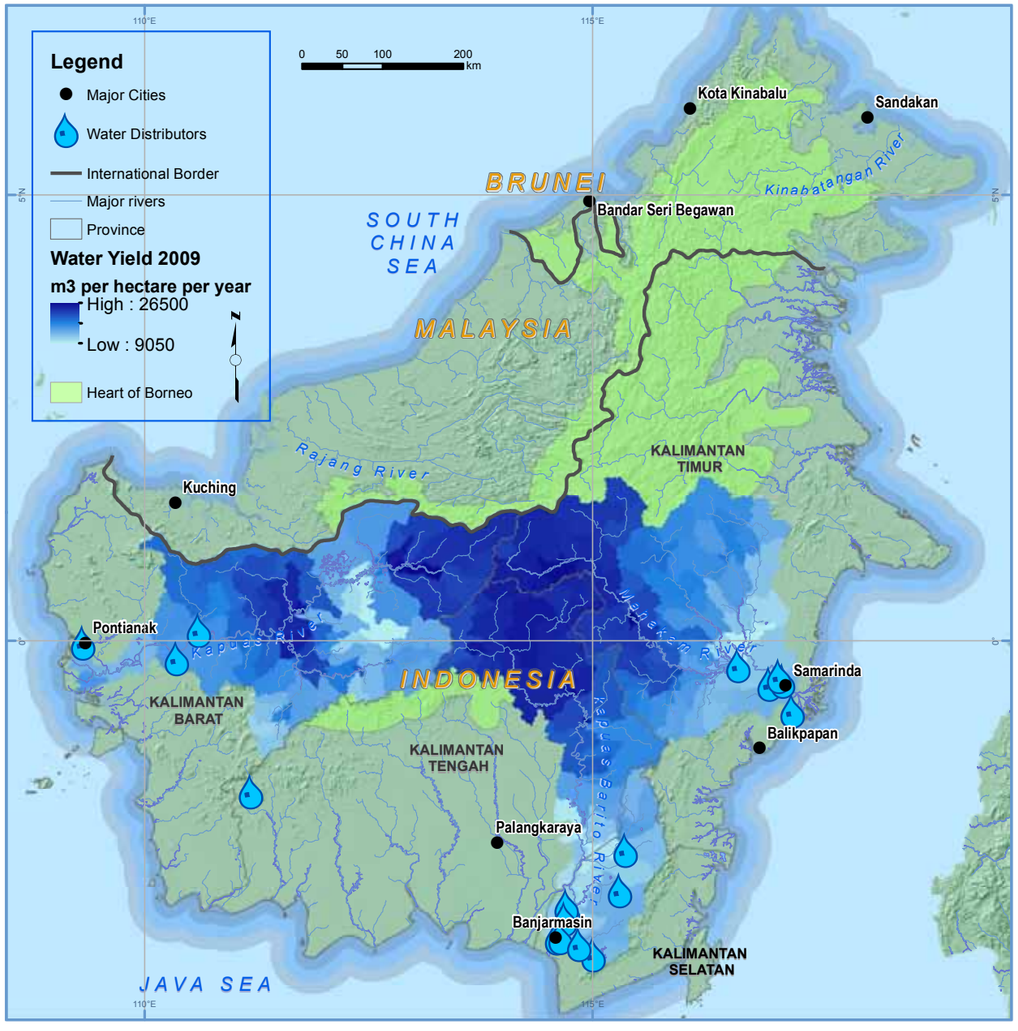
The HoB provides water to 29 river basins across an estimated 54 million hectares, or 70 per cent of Borneo (see Figure 2.5), reaching around 11 million inhabitants, including more than 70 per cent of the population of Kalimantan[41]. The study assessed a subset of physical impacts due to changes in the hydrological cycle within three of the most economically important catchments in Kalimantan, i.e., the Kapuas, Barito-Kapuas and Mahakam catchments. These impacts include changes in water availability, flood risk, and effective ecological infrastructure. The results are presented below.

Water availability: Based on Invest analysis, both the BAU and GE scenarios project a decline in total annual water yield, mainly because of an increase in plantation area under both scenarios compared to 2009 (Figure 3.9). Indeed, in the GE scenario, the protection of forest and expansion of plantation in some sub-catchments appears to increase water demand more than the BAU scenario. However, the simple InVEST annual water balance model does not account for seasonal changes and other factors that suggest that the BAU scenario would result in dry season water stress.

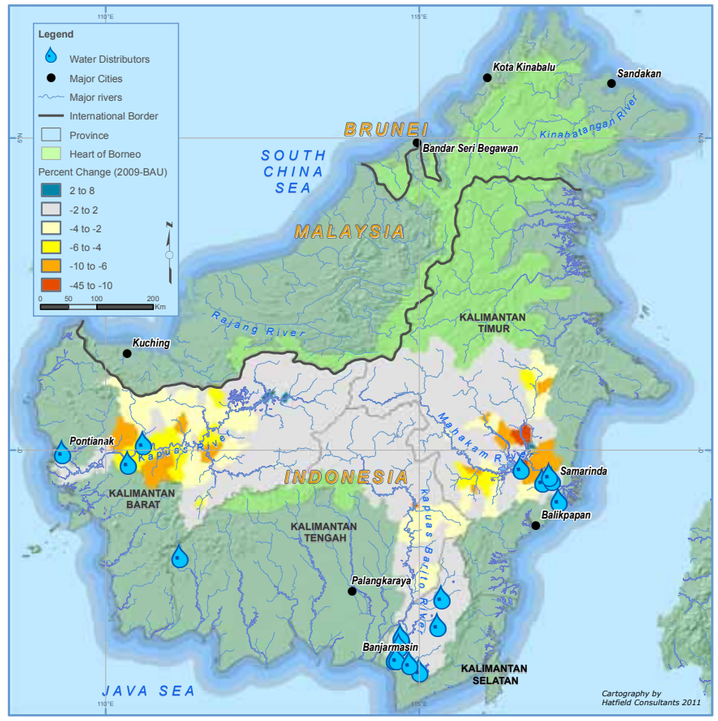
Water utilities in Kalimantan have already noticed a declining base flow of the river during the three driest months of the year. This forces water utilities to ration water distribution. Inhabitants that are not connected to the piped water distribution network face price increases from independent vendors during the dry season. Therefore, the study has attempted to calculate the socio-economic impacts of differences in water supply under the two scenarios. The estimate is based on the assumption that water availability in the dry season decreases by 5 per cent under the BAU scenario as compared with the GE scenario. In this case, the cost facing Kalimantan's water utilities for constructing drinking water reservoirs in anticipation of a decline in base flow in the dry season in the three main river basins is estimated at US$10 million.

In cities where saltwater intrusion occurs during the dry season as a result of a decline in the river's base flow, larger drinking water reservoirs will have to be constructed; alternatively, water intakes will have to be relocated to sources further upstream. Increased operational costs for the city of Pontianak alone are projected to reach US$2 million/year in BAU (see Box 2.3). For inhabitants in these river basins who do not obtain drinking water via these companies, the cost to secure water during the dry seasons would be US$3.9 million/year or US$30 per household per month.

The Heart of Borneo contributes as much as 60 per cent, 40 per cent and 55 per cent of annual water supply to the Kapuas, Kapuas-Barito, and Mahakam river basins, respectively. These basins provide water to 70 per cent of the population of Kalimantan.



(a)



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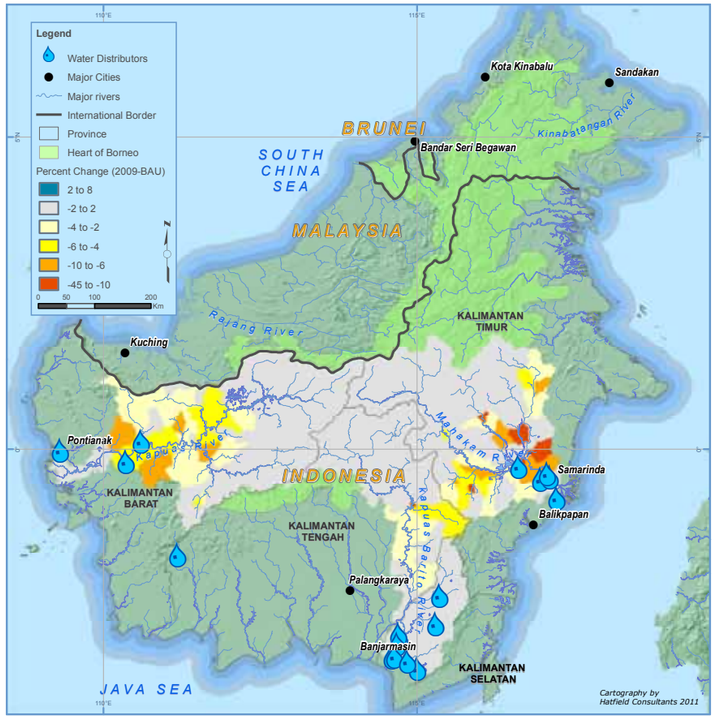
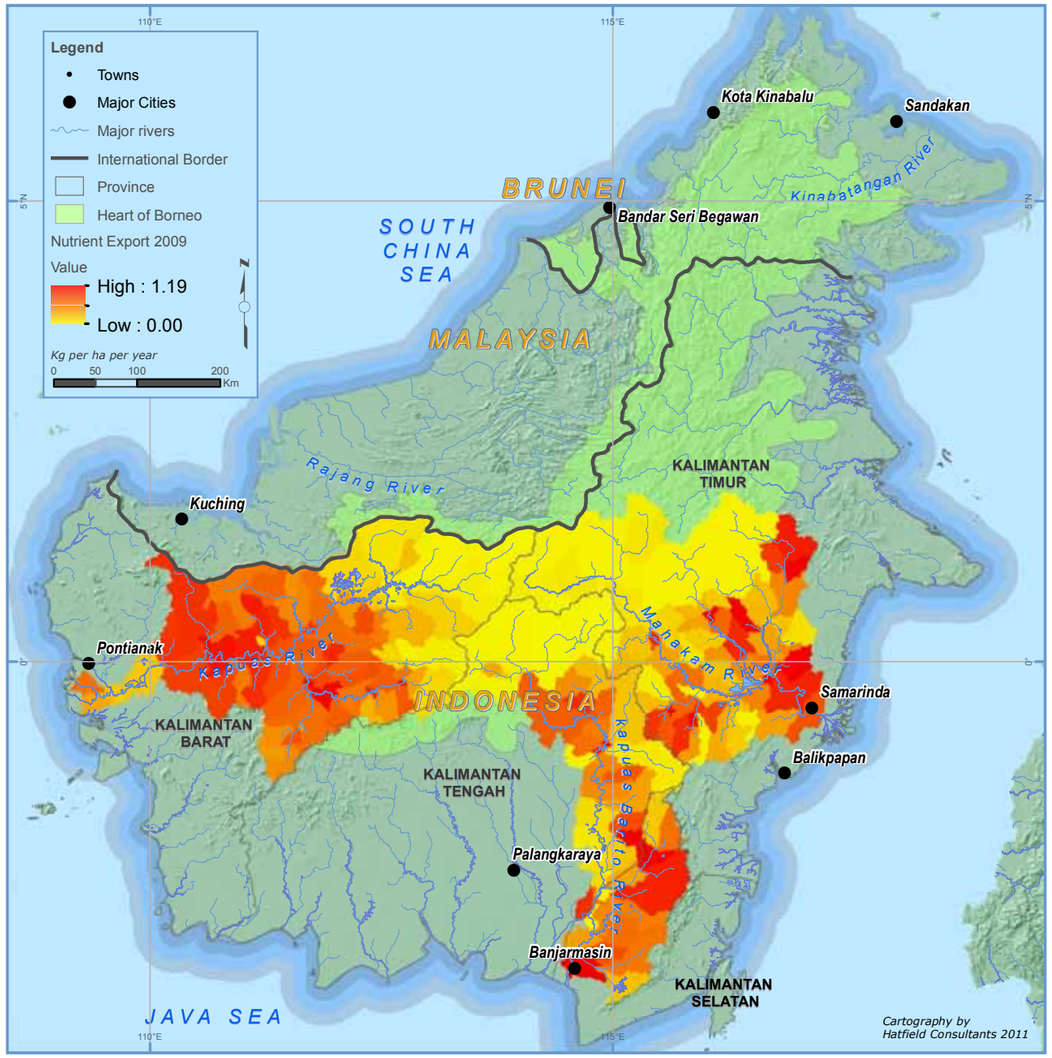


(c)

Figure 3.9: Water supply from the Heart of Borneo to the Kapuas, Barito Kapuas and Mahakam catchments shows a small decline in both BAU and GE scenarios, mainly due to an increase in plantation in both scenarios; (a) water supply 2009; (b) percentage change between 2009 and BAU 2020; (c) percentage change between 2009 and GE 2020

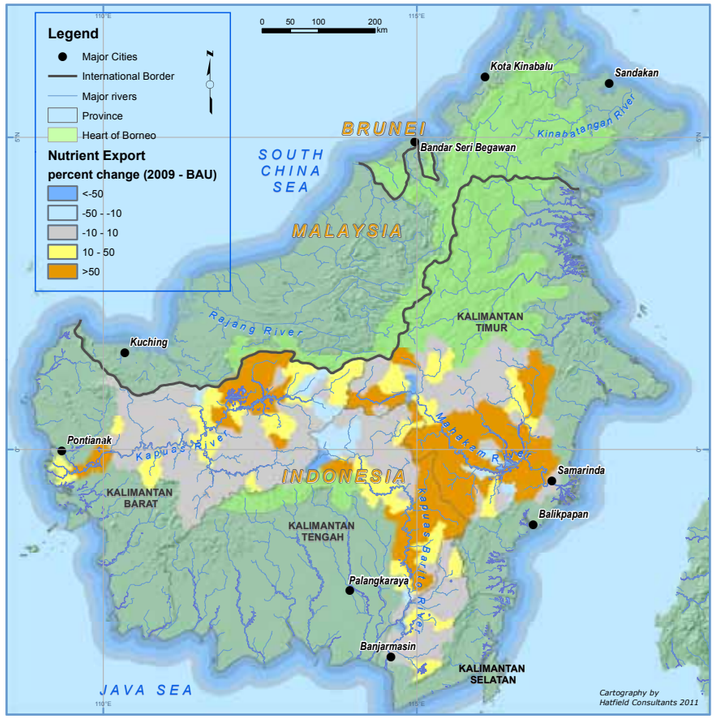
Water quality: Based on estimates prepared using InVEST, export of nutrients would be 12 per cent per year higher under the BAU scenario than under the GE scenario (see Figure 3.10), largely due to variation in the area of oil palm cultivation. An increase of this magnitude is likely to have substantial impacts on water quality and on aquatic biodiversity and coral reefs. Under the BAU scenario, the largest impacts occur in the Kapuas basin, due to major expansion of palm oil plantations, affecting as many as 11 Indonesian local water utilities. Additional application of fertilizer and loss of filtering riparian forests along waterways could increase nutrient export tenfold compared to 2009 in the three basins.

A standard way to try to quantify this is by use of a proxy, which in this case would be the cost of removing the nutrients from the surface water. The cost of removing nitrogen from surface water is approximatelyUS$3.20/kg N[42]. The benefits of a green economy, in which 12 per cent less nitrogen is exported than under a BAU scenario, may therefore be estimated at US$1.9 million/year[43].



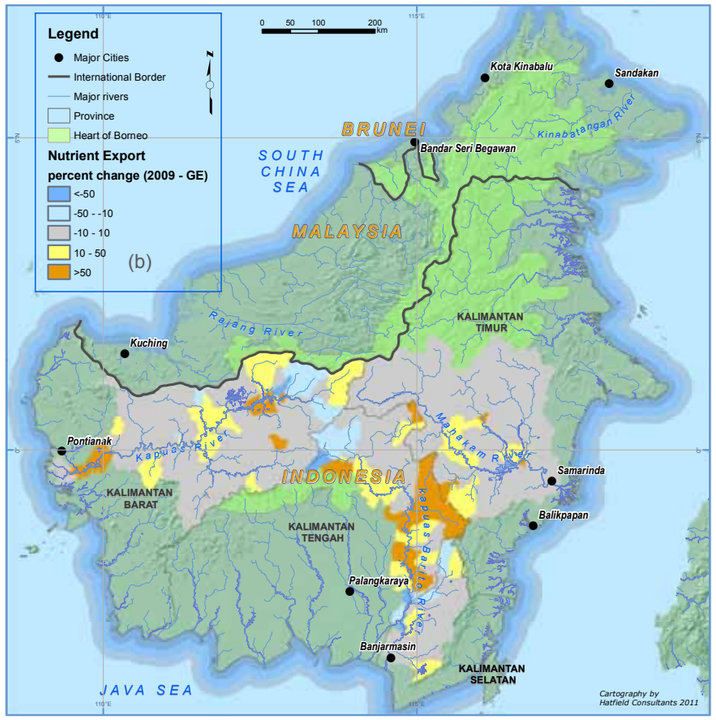
(a)

Figure 3.10: Nutrient (nitrogen) export from the Heart of Borneo to the Kapuas, Barito Kapuas and Mahakam catchments shows that more than a ten-fold increase in nitrogen export occurs under the BAU scenario compared to the GE scenario; (a) nutrient exports 2009; (b) percentage change between 2009 and BAU 2020; (c) percentage change between 2009 and GE 2020



(b)

Under BAU, additional application of fertilizer and loss of filtering riparian forests along waterways could increase nutrient export tenfold compared to 2009.



(c)

Water quality is impacted by large scale palm oil development.

Effective ecological infrastructure: Expected increases in average precipitation and deforestation under the BAU scenario are likely to result in higher levels of soil erosion, which could be compounded by an increase in average precipitation as a result of global climate change. As a result, the BAU scenario presents a worsening trend of river siltation and sedimentation, which will require additional infrastructure investments (for transport and energy in the specific cases analyzed) both for additional maintenance and for construction to make up for the ecological infrastructure lost, e.g., reduced river use. On the other hand, due to the protection of watersheds in the green economy, this scenario projects no significant increases in soil erosion after 2011, thus creating no extra burden on infrastructural maintenance and investment.

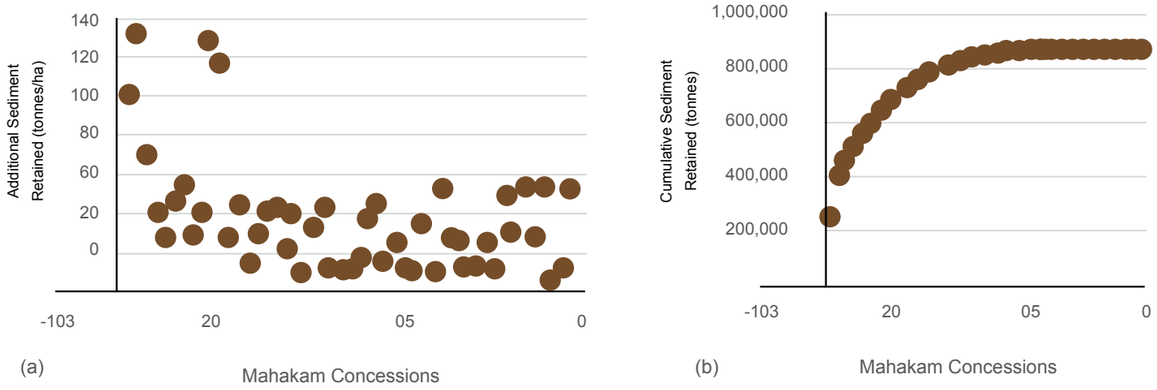


Figure 3.11: a) Additional sediment retained in the GE compared to BAU for the 49 timber concessions in the Mahakam basin b) cumulative additional sediment retained in the GE for the 49 timber concessions in the Mahakam basin

The InVEST Sediment Retention model was used to analyze gains in sediment retention for the Mahakam catchment associated with moving from the BAU to the GE scenario. Conventional logging (CL) in the BAU scenario was compared with reduced impact logging (RIL) in the GE scenario. Improved timber management greatly improved sediment retention across the 49 timber concessions in the basin, with a mean additional retention of 37 (±12) tonnes of soil per hectare (Figure 3.11 a), and close to 900,000 tonnes across the basin as a whole (Figure 3.11 b)[44].

GE scenario results in more effective ecological infrastructure.

The socio-economic impact of river sedimentation can be felt by communities and companies that use the river for transport, hydropower and irrigation reservoirs.

Hydrological models are not available for the river basins in Borneo to assess the impact of the BAU and GE scenarios on sedimentation in the river in more detail. However, based on the analysis of the InVEST outputs for the Mahakam catchment and system dynamics model, in a BAU scenario, new infrastructure (railway, roads) will likely need to be built in order to solve transportation problems arising due to river sedimentation. Total costs of potentially avoided value generation, along with the cost for construction of new infrastructure, could reach tens of millions US$ per year. In addition to this, roads and other manufactured infrastructure are impacted by extreme weather events (see section on 'reduced frequency of floods'). In the GE scenario, reduced deforestation reduces sedimentation of the river system (Figure 3.12). Regular dredging would still need to take place, but other infrastructure like railways and roads would not need to be built.

It should be noted that under BAU, when the river system is no longer being maintained since bulk transport uses other infrastructure, it will be local people who will be limited in their mobility. For them, the river system is the cheapest, and in some cases only, means of transportation.

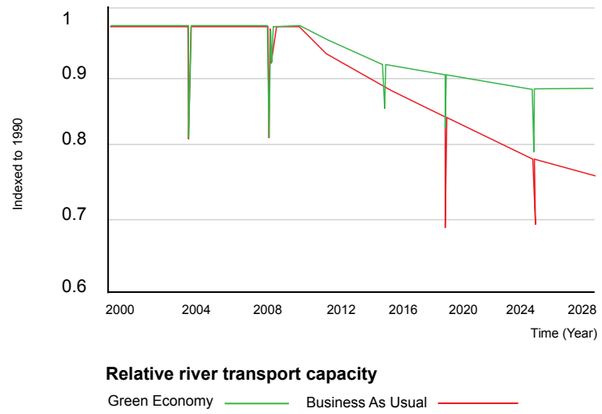


Figure 3.12: Historical and future projections of relative river transport capacity (e.g. 0.8 signifies a 20 per cent reduction in use relative to maximum capacity) in the BAU and GE scenarios

Reduced frequency of floods: Flood events in the model are driven by a variety of factors. Precipitation is certainly a key element, which includes long-term trends driven by projected climatic changes, medium-term cycles related to El Niño, La Niña and seasonal variability. Five-year cycles for major floods, as observed historically, are also accounted for. The relation between floods and deforestation remains subject to debate. Generally speaking, infiltration capacities of undisturbed forest soils are such that they easily accommodate most rainfall intensities. Forest clearing may result in soil disturbance that can lead to increased run-off during intense rainfall. Especially after burning and land clearance using heavy machinery, soil compaction will take place and increased surface run-off will occur (Bruynzeel, 2004). No specific study has been done to quantify this relationship; however, during the participatory process, stakeholders from Kalimantan recognized the relation and included it in the Causal Loop Diagram.

Based on historical trends, the BAU scenario assumes that, the number and strength of flood events due to increased precipitation (and variability), deforestation and forest degradation will increase by about 10 per cent relative to 2011 (Figure 3.13). While the BAU historical trend continues almost linearly, characterized by known trends of deforestation, the GE scenario curbs these trends and lowers flood frequency and strength. As a consequence, flood events and related damage to roads, agriculture, river use, etc., are estimated to grow over time in the BAU case—a problem which is avoided in the GE scenario.

To put flood events and associated impacts into context, annual damages to households in the three major river basins—Barito-Kapuas, Kapuas and Mahakam—are estimated at about US$12 million. A 10 per cent increase in the probability of flooding would therefore cause an average increase in total annual damages to households of US$1.2 million.

Besides the impacts on households, responding to disruption of ecological infrastructure often requires investments, such as expanding built up infrastructure and maintaining it properly. Roads and other manufactured infrastructure are particularly vulnerable to extreme weather events. Floods can damage roads considerably, generating additional costs for maintenance and/or complete rebuilding. Apart from seasonal events—which cannot be avoided—medium- and longer-term trends of deforestation under the BAU may increase the vulnerability of roads to floods. This in turn would lead to more rapid depreciation (in the range of 10 per cent per year), indicating an average lifetime of roads of about 10 years in the medium and longer term in flood-prone areas, based on historical trends and a simplified calculation (for assumptions used, see Table 3.2). In GE projections, on the other hand, roads will last longer. The average lifetime of roads is extended and transport infrastructure expenditure is reduced. The costs associated with floods are calculated by multiplying the baseline road depreciation (using a five-year lifetime for roads without maintenance and up to 50 years of lifetime with annual maintenance) by the flood trends projected for both BAU and GE scenarios.

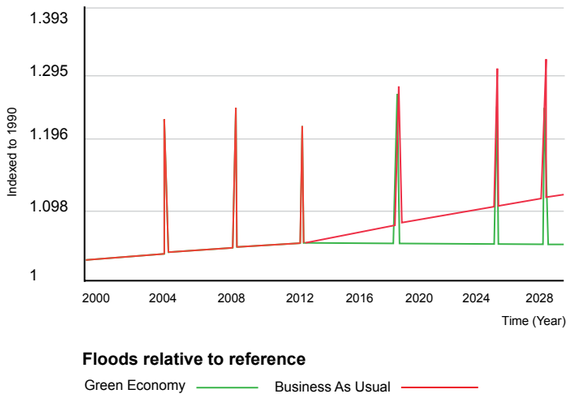


Figure 3.13: Historical and future projections of relative flood frequency and strength (e.g. 1.2 signifies a 20 per cent increase in flood events and peaks indicate events of higher strength) in the BAU and GE scenarios

Soil services

A variety of factors tends to increase soil's ability to perform its function in natural and sustainably managed ecosystems. Among others, specific interventions in support of soil services in the GE scenario include the reduction in use of chemical fertilizers in favor of more organic and ecological agriculture practices. The following characteristics of soil services will vary according to the scenario selected:

Organic matter – carbon: Tropical deforestation causes significant losses of soil carbon and nitrogen, which tend to decline further under continuous cultivation. Reasons for declines in soil fertility include accelerated soil erosion, loss of litter influx after canopy removal and enhanced decomposition and nutrient mineralization rates after forest clearance. The soil management techniques simulated in the GE scenario conserve and improve stocks of soil organic matter (SOM) in the HoB. Interventions include agroforestry techniques, intercropping with legumes and the use of mulches and other organic inputs.

Soil water holding capacity: Tropical soils have moderate intrinsic water holding capacity. However, topsoils can be readily disrupted with a moderate effect on hydrological cycles, including water storage capacity (see Figure 3.14 a).

Nutrient flow: Natural capital conservation supports a fast nutrient cycle through the plants and the surface layers of the soil, avoiding the need to use exogenous inputs to increase soil fertility.

Soil erosion: Maintenance of forest cover, one of the results of the GE scenario, is one of the principal means of reducing soil erosion. In the BAU scenario, deforestation and forest degradation cause more overland flow of water and therefore increased sediment transport capacity. Another result of increased soil erosion is transport of nutrient-rich litter and topsoil in overland flows to streams and leading to reduced soil productivity, disrupted natural water flows and eutrophication.

GE scenario results in enhanced soil services.

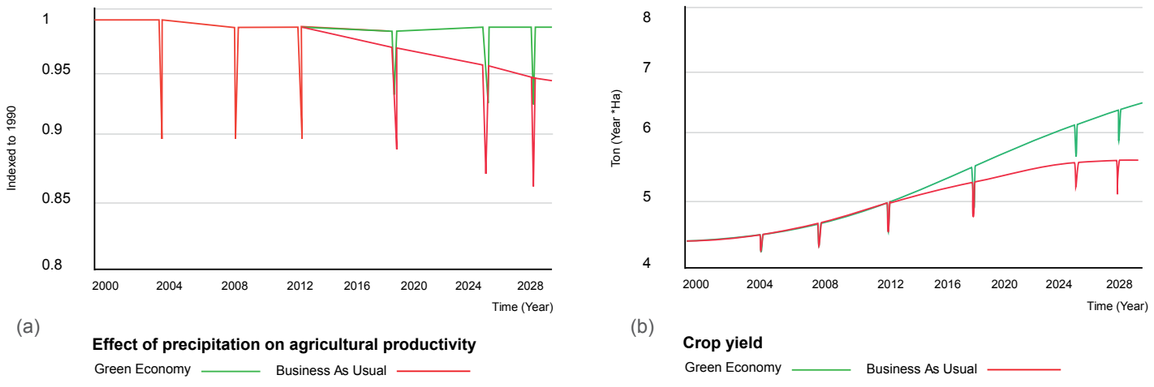


Figure 3.14: (a) Historical and future projections of the relative effect of precipitation on agriculture productivity (e.g. 0.9 signifies a 10 per cent reduction in productivity relative to optimal conditions) in the BAU and GE scenarios; (b) historical and future projections of agriculture crop yield in the BAU and GE scenarios

Envisioning a way forward

Based on the results of this economic and environmental modeling in Borneo, an alternative future which recognizes the value of natural capital is feasible; it reduces poverty, increases growth, builds local economies and supports climate change mitigation and adaptation strategies.

The assessment finds that investing in natural capital will:

- decrease future costs to businesses, households and government;
- increase future revenue from biodiversity-based and green industries;
- raise crop yields and lower domestic energy consumption, and;
- support a transformation to a more just and equitable economy.

A green economy results in the protection of ecosystem services benefiting Borneo's economy and society, as well as global stakeholders. For example, global stakeholders benefit from the effects of reduced carbon emissions, while local users benefits from waterways with less sediment export. From a social cost-benefit perspective, the benefits of a GE approach outweigh the costs. The type of policy package put in place to achieve a green economy will be critical in determining the kinds of investments that will be made and the incidence of costs and benefits, i.e., who will pay and who will benefit.

These results provide a basis for policy discussions regarding investments, policies and incentives to be put in place by national and local governments (see Part IV below).

To build upon this work, more extensive efforts—especially in systematic data collection and verifying relationships between ecosystem services and benefits at the local level—will be needed. Future efforts should concentrate on the verification of model results, collection of local data and improvement of model formulations. Even greater emphasis should be put on engaging local stakeholders, at all levels, and in all three countries. Subsequent findings could be actively used to support economic policy decision making on HoB's natural capital to create socio-economic as well as environmental benefits and synergies across borders.

A green economy results in the protection of ecosystem services benefiting Borneo's economy and society, as well as global stakeholders.

END NOTES PART III

[1] Due to the scope of this study, the models described in this chapter focus on the role of natural capital in the economy with limited modeling work on equity and distribution issues. It is assumed that sustained natural capital supports primarily the rural and poor communities that rely on nature for their livelihood. Healthier ecosystems with enhanced provision of goods and services will improve their standard of living.

[2] Constanza, Cumberland, Daly, Goodland, Norgaard. 1997. *Handbook of ecological economics*. International Society of Ecological Economics.

[3] See chapter 2.1 for a more detailed explanation of natural capital (natural stocks, ecosystem goods and ecosystem services).

[4] It furthermore shows that intangible social values also contribute to GDP, but in view of the scope of this study, we have focused mainly on integrating the value of natural capital.

[5] The methods used are inspired by the World Bank in *Where is the Wealth of Nations?- Measuring capital for the 21st century*" 2006, and used in *Toward a Green Economy – Pathways to Sustainable Development and Poverty Eradication* (UNEP 2011).

[6] Bovarnick, A., F. Alpizar, C. Schnell, Eds. 2010. The Importance of Biodiversity and Ecosystems in Economic Growth and Equity in Latin America and the Caribbean: An economic valuation of ecosystem, United Nations Development Programme, 2010.

[7] Due to the complexity of both natural and economic systems, methodological limitations to modeling, such as the correct representation and valuation of the ecosystem, remain. An ecosystem (ecological system) is the area where a complex set of relationships amongst natural resources exists together, being the basis for all human economic activity. We believe we can estimate the value of parts of the ecosystem, but its inner complexity makes it difficult to fully appreciate the nature and contribution of the ecosystem itself (as the combination of all parts) to socio-economic development. While we acknowledge that there are several methods for the estimation of the economic value of ecosystem services, we decided to focus on a method that relies on the estimation of the economic impact of reduced ecosystem services, and their consequences on the economy. Further, the "social value of natural capital" is also a key component of the net contribution of nature. While social values are often intangible, and will not be estimated quantitatively in this report, the report does emphasize the potential contribution of a green economy strategy to the preservation of the social value of natural capital in the HoB.

[8] On the topic of green economy modeling, including for forests, see United Nations Environment Programme (UNEP) 2011. *Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication.*

[9] See Annex I for stakeholder engagement processes throughout 2010, 2011 and 2012 on the role of HoB in a green economy.

[10] Except in settlement areas or mining concessions that are in the construction or production phase.

[11] International Council on Mining and Metals (ICMM). 2006. Good Practice Guidance for Mining and Biodiversity.

[12] Not all of them could be analyzed simultaneously and in detail due to lack of data. These interventions include, in particular, biodiversity-based industries and innovative green sectors.

[13] Clark Labs. 2009. *The Land Change Modeler for Ecological Sustainability*. IDRISI Focus Paper.

[14] Tallis, Ricketts, *et al*. 2012. *InVEST 2.2.2 User's Guide: Integrated Valuation of Ecosystem Services and Tradeoffs*. Stanford, The Natural Capital Project, Stanford University.

[15] Millennium Institute. 2005. *Threshold 21 (T21) Overview*. Arlington, VA, USA.

[16] Not all of the assumptions of the Business as usual (BAU) and Green Economy (GE) scenarios described in Table 3.1 above can be integrated into LCM models, and the focus is on spatially-explicit land cover and land use factors.

[17] Kareiva, Tallis, *et al*. 2011. Natural Capital: Theory and practice of mapping ecosystem services.

[18] It should be noted that some of the findings of InVEST could not be scaled up to Kalimantan in a way that would fit coherently within the integrated cross-sector analysis.

[19] See Annex IV for additional bibliography and data sources of system dynamics modeling.

[20] The value of ecosystem services would normally be included in the calculation of GDP, as the cost to restore ecological infrastructure increases costs and reduces profitability (or the overall productivity of the operation).

[21] Tallis et al. 2010

[22] The higher cost case is associated with a higher assumed price of carbon ($15 per tonne vs. $2 per tonne in the low cost case) based on literature and relating to the case in which emission reduction may turn out to be more expensive than expected (also depending on market conditions and the implementation of emission reduction mechanisms). On the other hand, higher carbon prices would create an incentive to invest more on the green transition, which leads to higher emission reductions but also higher overall costs as a ratio of GDP.

[23] Discounting is not applied when calculating these results. The model projects scenario results over time, providing annual (and more frequent) time steps for projections. Intervention costs, and the value of natural capital, among others, are assumed and/or calculated in real terms (constant monetary values, inflation adjusted). With these assumptions and projections, discounting is not necessary, unless explicitly requested by policy makers.

[24] All values are nominal; see previous comment re. use of discounting.

[25] These figures are generated by multiplying the area of primary and secondary forestland under each scenario by $27.3/ha, the economic value of biodiversity per ha used in the study (see the table 3.2 on assumptions).

[26] This value is obtained by multiplying the primary and secondary forest area by the potential value added generated from *land conversion* (see Table 3.2 on assumptions).

[27] Note that carbon can be seen as a natural stock but the primary natural stocks which require interventions are forests and soil.

[28] Koh L.P, H.K. Gibbs, P.V .Potapov, M.C. Hansen. 2011. Indonesia's forest moratorium, Environmental and socioeconomic tradeoffs for the Kalimantan region.

[29] These figures are not to be confused with potential payments under a REDD+ scheme, which would depend on estimates of avoided deforestation, avoided degradation and other "+" factors.

[30] This is calculated by multiplying agricultural land, obtained from the spatial scenario analysis, by the average value added/ha of productive land impacted by natural capital and precipitation changes in the BAU vs. GE scenario.

[31] The difference between the high and low estimates is based on the different carbon price assumptions, i.e., low (US$2/tonne) and high (US$15/tonne).

[32] Excluding any revenue from mining, timber and other ecosystem goods, and accounting solely for the value of nature *additional* to ecosystem goods.

[33] To go back to the terminology developed in 3.1 above, this ratio compares the magnitude of the stock represented by nature as a whole to that of the flow of GDP which, in part, is relying on that stock for essential inputs. In this sense, natural stocks may be comparable to the amount of money deposited in a bank account, while the annual value generated by natural capital represents interest payments. Of course, as natural capital becomes depleted, these payments will decrease.

[34] Some of the calculations of the outcome below are based on InVEST analysis, except for the River transport, Road disruption and Flood frequency, which were calculated using the macroeconomic System Dynamics model only.

[35] This amount is in "real" or "constant" value, as opposed to "current" value.

[36] Ministry of Forestry (Government of Indonesia). 2008. HPH dan penilaian LPI.

[37] Details of the methodology can be found in Annex III.

[38] Details of methodology can be found in Annex III.

[39] The estimations of social cost of carbon used in this report, are based on calculations of the Interagency Working Group on Social Cost of Carbon, United States Government, *Social Cost of Carbon for Regulatory Impact Analysis* under Executive Order 12866. 2010.

[40] Forest Research Institute Malaysia (FRIM), International Tropical Timber Organization(ITTO). 2001. *A Model Project for Cost Analysis to Achieve Sustainable Forest Management: Volume 1 Synthesis Report*. Kepong, Malaysia.

[41] Witteveen + Bos and WWF-Indonesia. 2011. *Quickscan watershed service valuation.* Technical Report.

[42] CIW (Coordinaten commitee Integrated Water management). 1999. Financiering van het zuiveringsbeheer. kosten van de behandeling van afvalwater, Haskoning, Nijmegen.

[43] This is a high case estimate, as not all nitrogen export is necessarily negative and impacts should still be assessed locally as thresholds are different in different places. Yet in general, excessive nitrogen export affects aquatic biodiversity downstream negatively.

[44] Details of methodology can be found in Annex III.

PART IV:
DELIVERING THE GREEN ECONOMY: THE LEADING ROLE OF GOVERNMENTS

Part IV:

Delivering the Green Economy: the Leading Role of Governments

Overview

Part IV discusses the leading role of governments in delivering the green economy.

Chapter 4.1 presents the current state of affairs in delivering a green economy, particularly the challenge of mainstreaming natural capital into national and sub-national efforts. The only section of the report organized according to political boundaries, it describes recent steps taken by Brunei Darussalam, Indonesia (Kalimantan) and Malaysia (Sabah and Sarawak) to move towards a green economy, along with key further steps needed.

Chapter 4.2 provides an example of an economic policy package that would sustain HoB's ecosystems and biodiversity. It outlines a range of economic instruments that could be employed to drive green growth in the HoB when implemented in synergy.

Chapter 4.3 presents a set of proposed targets and indicators for measuring success in transitioning to a green economy.

Finally, **Chapter 4.4** looks at the broader, enabling role of governments beyond the development.

FIGURES

TABLES

BOXES

4.1 MAINSTREAMING NATURAL CAPITAL INTO PLANNING, POLICY AND ECONOMIC DECISION MAKING

What's in this chapter

- Recent steps taken by Brunei Darussalam, Indonesia (Kalimantan) and Malaysia (Sabah and Sarawak) to move towards a green economy
- Key further steps needed

The results presented in Part III reveal—for most indicators—significant differences between outcomes under the two different scenarios. Together, these illustrate that, particularly in the long run, a green economy may have substantial environmental, social and economic advantages over the BAU scenario.

The Brunei, Indonesia and Malaysia governments have already begun to take coordinated action to recognize and act upon the value of natural capital, not least among which has been the transboundary collaboration known as the 'Heart of Borneo Initiative'[1] launched in 2007.

A priority challenge facing the three governments—one highlighted in a recent three-country publication, *Financing the HoB: A Partnership Approach to Economic Sustainability*[2] (see Chapter 1.2 and Figure 1.1)—is the need to harmonize HoB plans and current development plans in order to reflect economic, social, climate, biodiversity and poverty reduction objectives. This chapter describes these and other challenges in more detail while highlighting ongoing efforts in the transition towards a green economy.

By conserving ecosystem services and encouraging sustained resource productivity, the Heart of Borneo Initiative supports inclusive and green growth on Borneo.

It describes the achievements that individual governments have already made, before sketching an example of an actual policy package that aims to address the policy implications of the scenario comparison from the previous parts. It suggests indicators with which to track in specific the landscape-related targets to track progress towards a green economy and concludes with the instrumental role of governments.

The Heart of Borneo (HoB) Initiative is an international effort built around transboundary cooperation to enable collaborative and lasting conservation and sustainable development. Commitments of the three HoB governments (Brunei Darussalam, Indonesia and Malaysia) to pursue this objective are defined in the Heart of Borneo Declaration, the tri-national Heart of Borneo Strategic Plan of Action, and each country's Project Implementation Framework and/or Strategic Plan of Action. Governance structures have been established at national and sub-national levels to develop and guide the conservation and sustainable management of committed forestland: Brunei's Heart of Borneo National Council, Indonesia's Heart of Borneo Working Groups at national, provincial and local levels, and Malaysia's National Expert Group and state level Steering Comittees (see above, Box 1.1).

The HoB Initiative is clearly recognized within the development frameworks of all three countries at relevant national and provincial/state levels. However, natural capital has not yet explicitly been quantified in economic models and accounting frameworks, despite the importance of doing so in order to measure and support sustainable growth. The many values of HoB's natural capital—including its critical role in the economy, in supporting broader human welfare and in creating resilience to climate change—remain poorly recognized in current economic and development plans. To fully realize the Heart of Borneo Declaration, and to make further progress in their transition to a green economy, Brunei, Indonesia and Malaysia need to take account of the essential contributions of HoB ecosystems and biodiversity within national/local economic and development plans. Doing so will set the stage for enhanced management of, and increased investment in, HoB's natural capital.

Brunei

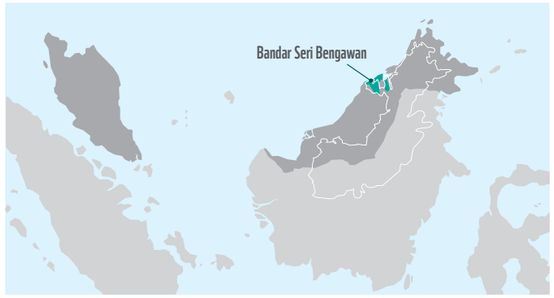


Figure 4.1: Brunei Darussalam

The Sultanate of Brunei Darussalam is a sparsely populated country with approximately 400,000 inhabitants, nearly 70 per cent of whom live in the capital Bandar Seri Begawan (Figure 4.1). Brunei's economy depends mainly on crude oil and natural gas production, including liquefied natural gas (LNG) operations and a methanol plant. The wealth that has flowed from its oil and gas production has allowed Brunei to maintain the majority of its land area under natural forest cover. According to the Permanent Secretary of the Ministry of Industry & Primary Resources (MIPR), at least 74 per cent of Brunei's land area remains forested (58 per cent being primary forest according to the HoB PIF[3]) and 41 per cent of its land is gazetted in various categories of forest reserve. The upper catchments of all major rivers remain largely pristine, and there are totally protected examples of all forest types in the country.

Brunei does not export timber; it produces approximately 80 per cent of its national requirement and imports the remaining 20 per cent. The Forest Resources and Strategic Planning Study (1984) predicted an acute timber deficit by 2015, when the mixed dipterocarp forests (MDF), the country's main source of timber supply, would be completely logged over. To avert this, the Forestry Department halved the annual allowable cut from 200,000 cubic metres to 100,000 per annum starting from 1990. This action was designed to delay severe deficits until 2045.

At the same time, the Forestry Department began a sawn timber plantation programme with a target of 30,000 hectares of plantation. Originally, these were to have been monocultures of exotic species; however, the current practice is to convert natural forest to "plantations" that comprise alternating strips of cleared land planted with native timber species together with natural forest. In practice, more than half the area is left under disturbed natural forest because areas that are unsuitable for planting (i.e., mainly steep land and water courses) are left in this condition. As part of the same forestry policy, remaining land under forest is intended to be set aside for permanent protection with no timber harvesting.

One goal of the above forest landscape management system is to benefit biodiversity both by conserving most of Brunei's forest cover in its natural state and also by making timber harvesting relatively biodiversity friendly. This involves maintaining as much forest cover and connectivity as possible, with benefits to natural capital and also to such environmental services as watershed protection, support for ecotourism, public amenities, carbon storage, etc. In principle, it should be possible to estimate the quantities and value of such benefits.

His Majesty the Sultan of Brunei and his ministers have repeatedly underlined the country's commitment to HoB and approved the designation of 58 per cent of Brunei's land area as a special area for that purpose. The HoB Project Implementation Framework[4] goes further in redrawing the HoB boundary to encompass 74 per cent of the country, a proposal that is still under consideration. The HoB Initiative is therefore a central element of Brunei's sustainable development agenda.

Wawasan Brunei 2035

The Brunei Darussalam Long Term Development Plan (2007-2035) consists of the National Vision, the Outline of Strategies and Policies for Development (OSPD, 10-year document) and the National Development Plan (NDP, 5-year document). The National Vision, known as Wawasan Brunei 2035, aims to make Brunei Darussalam, by 2035, a nation widely recognized for: (1) a world class education and skilled workforce; (2) a high quality of life; and (3) a dynamic and sustainable economy. The National Vision also aspires to raise the sultanate into the ranks of the top ten nations of

the world in terms of quality of life and GDP per capita by 2035. In addition, the government has repeatedly stated the national commitment to conserving its biodiversity as part of HoB and the BIMP-EAGA 'Megadiversity Sub-region'. The NDP (2007-2012) emphasizes the protection and conservation of the environment and interventions that would support a green transformation of the economy. These include the maintenance of forest production and plantation, water resources conservation, prevention of soil erosion, rehabilitation of wasteland, waste recycling and reuse, and the preservation of biodiversity and endangered species.

The government of Brunei Darussalam's policy of economic diversification, underpinned by a desire for more balanced and sustainable growth, aims at a transition away from fossil fuel dependence towards a more advanced 'knowledge economy'. The success of the diversification strategy is crucial for the future of Brunei Darussalam. In the context of the HoB, since the wealth generated from petroleum reserves[5] has historically limited the need to exploit other forms of natural resources (in particular timber), more marked changes in land use can be expected in the future if the growth of income is not sustained. Rising pressure to exploit non-energy natural resources may therefore be experienced, undermining current and future efforts to preserve natural capital.

Towards a green economy in Brunei

While Brunei's HoB programme has to support the overall trilateral plan for HoB, it also lies at the core of Brunei Darussalam's transition to an economy which properly recognizes, values and conserves natural capital, particularly the provision of ecosystem services. Management of water assumes particular importance in this regard, beginning with water supply.

Given the increased demand from water intake at Badas pumping station in Belait River, changes in the upper river could lead to shortages of water in the dry season. A dam has already been constructed to reduce the impact of salt intrusion in the dry season. To buffer the Belait water supply in the dry season, the Kargu dam is being developed to form a buffer basin upstream of the Belait River. In the dry season, this basin should be able to release water back into the Belait River.

As the sole suppliers of water for industrial, agricultural, domestic and inland transport uses throughout two districts that together comprise approximately 70 per cent of the country's land area, the Belait & Tutong river basins—both of which have their upper and middle catchments within HoB—play a crucial role in national water security as well as in the overall economy. They provide an important example of the need to invest in a well managed ecosystem to sustain just one indispensable environmental service out of many that the ecosystem provides. The value of the catchments to the national economy and in maintaining life-support systems needs to be measured as part of the country's economic planning process. In this case, other values, such as those deriving from biodiversity, scenery and other amenities, should also be calculated to support national land-use planning.

In this particular case, the LNG-compression operations and other spinoff industries such as the Brunei methanol plant are dependent on Belait river water. A failure in supply of water would shut down a very significant percentage of Brunei's industry, with significant impacts on national GDP. The question remains whether the changes in water availability are being influenced by other water users or by changes in upstream conditions or by both of these. In other words: will investments in maintenance and management of the catchment be enough to guarantee a consistent and secure water source that justifies payments for watershed services? A cost-benefit analysis should study what is the most efficient and effective option for the district to manage its long-term water supplies. A system of fair and equitable payments should be derived from that analysis to generate sustainable financial flows for river basin management.

A second important issue, also involving water, is the management of peatlands. An ongoing project under the HoB Brunei PIF is the re-wetting of degraded peat. This serves a multitude of purposes for the benefit of the economy and society. Rewetting degraded peat raises the water table, thereby improving the hydrological cycle and ecosystem functions. Natural peatlands act as sponges that if properly managed can help to mitigate flooding by absorbing excess water when there is heavy rainfall, storing a relatively large amount of that water, and releasing it in a manageable flow. This benefits surrounding communities, agriculture and industry by shielding them from the extremes of floods and droughts.

Peatlands also contribute to global climate mitigation by: (1) avoiding further carbon emissions, (2) restoring the carbon sequestration function of peat (which is estimated at up to six times higher than that of dry-land forests, at least where the peat is relatively deep) and (3) encouraging carbon sequestration by restoring vegetation on degraded peat. The carbon store in Brunei's 90,884 hectares[6] of peatlands is estimated at between 280 and 336 Megatons (depending on whether 50 kg or 60 kg carbon content / m3 of peat is assumed[7]). Ninety five per cent of Brunei's peatlands are located within the HoB landscape. There is an estimated 20,000 hectares of disturbed peat in Brunei (of which 18,000 hectares is within the HoB landscape), which is estimated to emit 0.33 Mt of CO_2/year due to drainage (figure does not include emissions arising from fires[8]). Restoration efforts are ongoing. Implementing the HoB Initiative, including conservation of peatlands, would strongly support the Brunei Government in meeting its emission reduction targets.

Mainstreaming Brunei's HoB PIF within the comprehensive Vision and National Development Plans would add to cross-sectoral coherence, complementing existing and upcoming strategies that focus on more traditional instruments to support economic growth (e.g. infrastructure investment).

> Mainstreaming Brunei's HoB Project Implementation Framework to the comprehensive Vision and National Development Plans can add to cross-sectoral coherence, complementing existing and upcoming strategies that focus on more traditional instruments to support economic growth.

Indonesia: Kalimantan

Figure 4.2: Indonesia

Indonesia has the highest population in Southeast Asia and is the 4th most populous country in the world. The four provinces making up Kalimantan are East Kalimantan, Central Kalimantan, West Kalimantan, and South Kalimantan, which together have close to 14 million inhabitants[9] (Figure 4.2). The HoB landscape is in West, Central and East Kalimantan, covers 30 per cent of Kalimantan, and includes the upper-catchment areas of eight river basins providing important watershed services to the provinces and neighbouring countries (Figure 2.5).

As a contiguous tropical forested landscape, these three provinces are also important, ecologically-connected systems providing natural habitats for the endangered orangutan and other species of primates, as well as important bird life such as the Argus pheasant and hornbills. Plant life includes wide varieties of rare woods, rattan and resin, as well as the Rafflesia, the world's largest flower.

Master plan for the acceleration and expansion of economic development of Indonesia (MP3EI)

Kalimantan is extremely rich in natural resources, with an abundance of minerals, timber and agricultural resources. The nation intends to use these competitive advantages to accelerate and expand its economic development, as indicated in the Master Plan for the Acceleration and Expansion of Economic Development of Indonesia (MP3EI).

In order to realize the vision of becoming a developed and prosperous nation by 2025, Indonesia is determined to accelerate its economic transformation. The implementation strategy of MP3EI will integrate three main elements: (1) developing the regional economic potential in six Indonesia Economic Corridors (including Kalimantan's economic corridor); (2) strengthening national connectivity locally

and internationally; (3) strengthening human resource capacity and national science and technology. The MP3EI aims at transforming Indonesia into one of the world's ten major economies by 2025.

The development theme of the Kalimantan economic corridor in MP3EI is as a 'Center for Production and Processing of National Mining and Energy Reserves.' Table 4.1 summarizes the orientation of economic activities in Kalimantan according to the MP3EI. Human capacity and infrastructure development are treated as crosscutting themes.

The Government of Indonesia has adopted a four-track development strategy, namely: pro-growth, pro-job, pro-poor and pro-environment (National Development Plan 2005-2025). The MP3EI is the working document of the RPJM (medium-term development plan) at national and sub-national levels, which is intended to guide policy and development of an institutional framework supporting Indonesia's attainment of its four priorities.

There is growing evidence that the depletion of natural capital is negatively impacting ecosystem services, increasing costs for both society and the economy, with higher expenses being sustained by the private and public sector. Furthermore, the deterioration of natural capital is reducing the availability of ecosystem goods, a driving component of current macroeconomic growth paradigms as well as a key source of income for rural communities. Continuation of this trend could undermine growth potential in the medium to long term, including for mining and energy production, due to the need to increase investments to offset the decline of ecosystem services. Without a balanced approach to growth that also achieves pro-poor, pro-job and pro-environment goals, the MP3EI is unlikely to help deliver on Indonesia's National Development Plan priorities by 2025. Without an inclusive approach to growth—one which goes beyond exploitation of natural resources—the plan is unlikely to support creation of sustainable and inclusive local economies that benefit business, environment and society.

The strong focus on mining and energy for the long-term development of the economic corridor of Kalimantan poses severe challenges to natural capital as well as to society.

Towards a green economy in Kalimantan

Several initiatives are being undertaken at national level, as well as in Kalimantan specifically, to support sustaining, restoring and enhancing natural capital while continuing to develop economies and societies.

With respect to emissions reduction, of particular interest is the recently approved national action plan to reduce greenhouse gas emissions (known as the RAN-GRK[11]), which aims to achieve a 26 per cent reduction target while maintaining a 7 per cent rate of economic growth. Contributing sectors include forests and peat, agriculture, waste management, transportation and energy. During the G20 Summit in September 2009, the President of Indonesia put the country's ambitions to address climate change on the global stage when he stated that Indonesia plans, by 2020, to voluntarily reduce emissions by 26 per cent on its own or by 41 per cent with international support[12]. Several initiatives are evolving around forest conservation, restoration and emission reduction, including a Letter Of Intent (LOI)[13] signed between Indonesia and Norway in May 2010 for the transfer of US$1 billion to reduce greenhouse gas emissions from deforestation, forest degradation and peatland conversion. As part of the LOI, in May 2011, the Indonesian government announced a two-year moratorium on the allocation of new concessions on forestland, also highlighting which areas would be placed under the moratorium. While the international REDD+ mechanism remains under negotiation, recent multilateral and bilateral arrangements demonstrate that Indonesia is in a position to receive significant investments to deliver on REDD+ priorities and activities.

A national regulation on economic instruments for environmental management is under development by the Ministry of Environment. This new policy direction is designed to become the umbrella/cross-sectoral approach to the use of economic instruments for sustainable environmental management. There are three main elements of the regulation concerning the use of economic instruments in development planning: (i) internalizing of externalities, (ii) market-based instruments for pollution control and (iii) financial and fiscal incentives to influence businesses practices. The draft regulation is the first to provide mechanisms for conservation financing through, among others, the use of trust fund mechanisms and also the first to encourage corporate social responsibility to improve environmental quality. Known as the RPP-EI, this

Table 4.1: Orientations of Kalimantan's economy to 2025[10]

Economic activity	Baseline Status	Acceleration and Growth Strategy
Fossil fuels	• Kalimantan has large reserves of fossil fuels. • Oil & gas production in Kalimantan is decreasing due to depletion. • Current coal exploration status is: 70 per cent in East Kalimantan; 23.7 per cent in South Kalimantan; 3.1 per cent in Central Kalimantan; and 1 per cent in West Kalimantan.	• Increase national oil and gas production to one million bpd by 2025 primarily through exploration. • Encourage the extraction of large coal deposits located in inland Kalimantan, accessible with adequate infrastructure and supported by proper regulations while maintaining environmental sustainability. • Increase investments in new coal exploration.
Mining (non energy)	• 84 per cent and 29 per cent of all national primary iron ore and laterite iron ore reserves are found in Kalimantan. • Bauxite mining currently exports bauxite as raw material, i.e., no value added although the value of alumina is ten times that of bauxite.	• Encourage the creation of synergies and linkages in the industry chain, both upstream and downstream. • Regulatory and policy reforms to control illegal mining activities and implementation of high export duties to restrict raw iron ore export.
Palm Oil	• In 2008 palm oil plantations accounted for 53 per cent of total plantation area, while contributing 80 per cent of total plantation revenue. • Further expansion of palm oil plantation is limited by environmental considerations.	• Adopt intensification approaches to increase the production yields of the existing palm oil plantations. • Development of upstream industries through selective land development, conversion of productive land, and increase in crude palm oil production. • Regulatory reforms to enhance the investment climate. • Improve transportation infrastructure.
Timber	• Kalimantan is considered as one of the world's major 'lungs' due to its vast forest area that stands at 41 million hectares. • It has a production forest area of 29.8 million ha, of which only 52.7 per cent is exploited. • The forestry sector contains non-timber potential resources such as fruits, rattan, bamboo, bee hive, silk, eaglewood which can absorb carbon emissions under REDD+.	• Restrict log cutting production to Production Forest Development, while the utilization of natural forests will be directed to the potential use of non-timber forestry, to avoid depletion and to rehabilitate damaged natural forest. • Short- and medium-term investment plans of timber industry include commercial scale Industrial Plantation Forest Estate and Wood Production and Primary Timber Industry targeting 1.771 million ha across all provinces.

policy instrument aims to direct investment, tax/subsidy, government's responsibility and state spending towards improved environmental management.

Investment and economic policies will incentivize spatial/land use management in Kalimantan. Indonesia has designated its portion of the HoB territory as a Strategic National Area (KSN) under Presidential Regulation 26 (2008), due to its natural capital value. A recent Presidential Regulation 3 (2012) formalizes Kalimantan's spatial plan (which includes the HoB) and provides a good example of how Indonesia will deliver on its 7/26 commitment. In this regulation, the government confirms that 45 per cent of Kalimantan is designated for the preservation of biodiversity. A Presidential decree related to the HoB Strategic National Area, which details HoB's specific spatial plan, is also under development to guide conservation and development efforts in this area.

Several pilot projects are also ongoing, on payments for ecosystem services, low carbon growth and prosperity plans. A 'green economic corridor' project across West, Central, East and South Kalimantan is being led by Indonesia's REDD+ Taskforce within the President's Delivery Unit for Development Monitoring and Oversight (UKP4), with support from UNEP, WWF and other organizations. The provincial governments of East and Central Kalimantan have designed green growth strategies to link together their efforts to implement REDD+ activities. At the district level, several efforts are underway. For example, the district government of Kutai Barat is creating enabling conditions for a district-level REDD+ program which includes: spatial planning, governance, and stakeholder involvement to improve forest protection, utilize degraded lands for oil palm expansion and promote strategies to build local economies while securing carbon and socio-cultural values.

In addition to the above important steps, enhanced coordination amongst the various different initiatives will be essential to transit to a green economy for Kalimantan. Greening its economy will require that medium- to long-term development plans, particularly the MP3EI as the overarching framework document, take into account the importance of the following elements:

(1) Preserving biodiversity for provision of marketable/tradable biodiversity-based products (food, cosmetics, medicines etc.) and other biodiversity-based enterprises such as bioprospecting and bio-banking;
(2) Securing good soil quality for small scale agroforestry as well as larger scale agricultural and palm oil industries;
(3) Minimizing the costs of poor watershed management from erosion, sedimentation, loss of water supply, floods as well as impacts of water pollution to downstream economic sectors and households;
(4) Favouring and providing incentives to sectors which follow international standards of sustainable practices;
(5) Ecosystem-based spatial planning, which preserves land with high natural capital value providing multiple ecosystem services and specifically defines existing degraded land as one category, which will support the various interventions listed in the MP3EI and a more cross-sectoral distribution of investment;
(6) Diversifying the economy, valuing the contribution of nature through building biodiversity-based economies, setting up infrastructure needed to boost ecotourism, mobilizing new business models from using industrial "waste products", payments for ecosystem services (i.e. carbon sequestration)—all of which could complement the economic development plan through more equity and wider cross-sectoral reach.

A reallocation of investments to include the above interventions would secure natural capital for the benefit of the economy and more inclusive social development, and would help to ensure beneficial medium-to longer-term growth in Kalimantan. While economic growth in the short term may be less than under the current plan—which focuses on mining and energy development—medium- to longer-term growth could be expected to outpace expectations. This shift could help to create an increasingly resilient, equitable, resource efficient and low carbon economy.

Finally, strategic interventions in the HoB Strategic Plan of Action[14] that highlight the role of HoB in providing key services need to be aligned with the MP3EI for Kalimantan and with Indonesia's broader climate, equity / poverty reduction objectives. These include sustainable land use, policy reform and institutional capacity building to be applied to support better natural capital management involving local communities and the public and private sector. Investments to drive cross-sectoral alignment could secure important ecosystem goods for current and future revenue streams, as well as important ecosystem services to avoid unnecessary costs.

Malaysia: Sabah and Sarawak

Figure 4.3: Malaysia

There are two distinct parts of Malaysia: Peninsular to the west and East Malaysia to the east. East Malaysia, located on the island of Borneo consists of two states: Sabah and Sarawak. Sabah has a landmass of approximately 7.4 million hectares with over three million inhabitants and Sarawak has a landmass of approximately 12.4 million hectares and over 2.4 million inhabitants. The HoB landscape covers over four million ha of land in Sabah and over two million ha in Sarawak (Figure 4.3).

Sabah possesses a stunning array of natural landscapes, habitats and species. In particular, the forests on the east coast and interiors are key habitats for the orangutan, Borneo pygmy elephant and Sumatran rhino. Sarawak also possesses impressive biodiversity, providing homes for Proboscis monkeys, hornbills, and slipper orchids, to name a few. In addition to high biodiversity value, Sabah and Sarawak include several rivers and important watersheds that provide crucial ecosystem services to their own economic sectors and to those in neighboring countries.

Both states, in addition to providing ecosystem services, also provide economic value to the federal and state governments. Sabah's economy was traditionally heavily dependent on timber-based industries but, due to depletion of natural forests, has had to diversify to other revenue-generating industries. The key sectors that currently contribute to GDP include palm oil and tourism. In Sarawak, liquefied natural gas (LNG) and petroleum are the primary revenue sources, followed by timber and palm oil[15]. The economic health of both Sabah and Sarawak therefore depend on the health and sustainability of their natural resource bases[16].

Malaysia has a variety of documents that highlight the agreed way forward for the country. The conceptual framework is contained within the Vision 2020, which aims for Malaysia to be a developed country by 2020. Under Vision 2020, social and government transformation were defined first, and an economic plan was recently added: the New Economic Model (NEM), to be achieved through an Economic Transformation Programme (ETP). The ETP is driven by eight Strategic Reform Initiatives (SRIs) aimed at increasing overall quality of life with respect to three main characteristics: (1) income: increasing income per capita to US$15,000 – 20,000 by 2020, (2) inclusiveness: enabling all communities to fully benefit from the wealth of the country, and (3) sustainability: meeting present needs without compromising future generations. The main emphasis of the NEM and the 10th Malaysia Plan is therefore economic prosperity, with targeted annual growth of real GDP of through 2020. Nevertheless, failure to conserve and invest in natural capital could undermine long-run GDP growth and standards of living.

Sustainability of growth, as well as valuing environmental endowments, are relevant components of Malaysia's outlook and are reflected in sectoral objectives, such as improving the sustainability of the palm oil industry. Several sectoral policies in particular, which are designed to support progress towards reaching the Vision 2020, are also of interest for mainstreaming Sabah's HoB Strategic Action Plan and Sarawak's Draft Project Implementation Framework:

- The National Environment Policy (2002) integrates the three elements of sustainable development (economic, social and cultural development) and environmental conservation. The policy was formulated and adopted in 2002 and is based on eight inter-related and mutually supportive principles designed to harmonize economic development goals with environmental imperatives. These include, among others, stewardship of the environment, conservation of nature's vitality and diversity, sustainable use of natural resources and integrated decision-making.
- The National Policy on Biological Diversity (1998) aims to "conserve Malaysia's biological diversity and to ensure that its components are utilized in a sustainable manner for the continued progress and socio-economic development of the nation".
- The National Conservation Strategy (1992) sets out a framework which can be used to integrate more fully the many existing efforts towards natural resources management for conservation and development, to build on the strength of existing institutions and mechanisms, and to incorporate additional future efforts into the process of conservation as a key to successful and sustainable development.

- The Draft National Highlands Policy (2007) is derived from two studies on the highlands of Malaysia, the latter focused on the highlands of Sabah and Sarawak, two of the five economic corridors of Malaysia. The findings from the two studies provide the framework for an integrated approach towards conservation and sustainable use of Malaysia's highland areas.

Sabah Development Corridor (SDC)

The socio-economic development trajectory of Sabah is set out in the 2008-2025 Sabah Development Corridor (SDC), which aims at transforming the state into a leading economic region, while pursuing social and sustainable development. As part of Malaysia's five economic corridors development strategy, the program is driven by three main principles: higher value economic activities, balanced economic growth with distribution and sustainable growth via environmental conservation.

The SDC initiative aims to triple Sabah's per capita GDP and increase its GDP by four times by 2025. In total, more than 900,000 new jobs are expected to be generated during the implementation period. The 18-year development strategy aims at accelerating development efforts (social, economic, physical and environmental), while building on the state's natural strengths, namely its strategic location, rich resources and cultural and biological diversity.

The SDC Blueprint intends to put together a competitive package that could attract new private investments in the state, while building new infrastructure, enhancing the human capital basis and improving the public service delivery system. Key outcomes identified for each economic focus area include:

(1) Tourism: increased tourism receipts and average tourist spending[17];
(2) Logistics: reduced cost of doing business in Sabah relative to other states in Malaysia;
(3) Agriculture: enhanced food self-sufficiency and organized planting of high-value crops for exports;
(4) Manufacturing: accelerated growth of downstream manufacturing activities, leveraging Sabah's rich natural resources such as palm oil, oil and gas, minerals and timber (resource-based manufacturing).

The SDC strategy interacts with a series of sectoral policies and regional priorities which capitalize on Sabah's natural capital while aiming at its more sustainable use. Coal resources are abundant in Sabah and in light of the 10th Malaysian Plan's target of reducing coal imports and increasing regional energy security, construction of a new coal power plant in Lahad Datu was planned. However, this proposal has recently been rejected by the State Government, as the environmental impact assessment did not sufficiently address many environmental parameters. Meanwhile, the state government has made the decision to refrain from developing coal resources within the Maliau basin, declaring it a protected area. In 2002, the state adopted the Sabah Conservation Strategy, focusing on wise land-use and calling for the establishment of a number of protected areas and improved management of resources. The Sabah Forestry Department seeks to make logging more sustainable with its Sabah Forestry Policy; adopted in 2005, the policy targets sustainable management of the state's forest resources.

Sarawak Corridor Of Renewable Energy (SCORE)

The resource-rich, export-oriented state of Sarawak has embarked upon a specific development strategy for sustaining the state's economy with new investments and growth opportunities in key sectors. Sarawak's economy is traditionally based on exploitation and international trade of natural resources, leaving it vulnerable to global shocks, while allowing it to enjoy frequent surplus fiscal balances, particularly after sharp rises in commodity prices in recent years.

The Sarawak Corridor of Renewable Energy (SCORE)—one of Malaysia's five regional development corridors—is an important catalyst for the state's future growth. The main focus of SCORE is to leverage Sarawak's energy resources, particularly hydropower, coal and natural gas, to create new investment opportunities that would spur job creation and income growth. The ten industries that will spearhead the SCORE are: aluminum, glass, steel, oil-based, palm oil, fishing & aquaculture, livestock, timber-based, marine engineering and tourism industries. The corridor's development is promoted through the following five-priority strategy:

(1) Three major growth nodes along the Corridor to drive investments into priority industries– Tanjung Manis (south), Mukah (center) and Similajau (north);
(2) Well-structured network of industrial class transport and communication infrastructure within the Corridor, with connections to the hinterland;

Box 4.1: Sabah and Sarawak's economy and watershed services

In Sabah's Labuk river basin, there is a distinct link between logging and large-scale palm oil and sediment and nutrient discharges. These are impacting coastal sectors such as aquaculture in Labuk Bay and the tourism industry on Turtle Island Marine Park. Plans for a hydroelectric power plant (HEP) and seasonal scarcity of water indicate the interdependency of Sabah's economy and natural capital.

Large-scale oil palm plantations in the Kinabatangan river basin pose a threat to forests and their provision of ecosystem services. More frequent and longer flood events in the floodplains of Kinabatangan have been among the results. While oil palm plantations are suffering from the impacts of higher and more frequent floods, with economic losses as a result, other sectors are also impacted by floods. These include the tourism industry, aquaculture and Kinabatangan's population in general.

With several hydroelectric power plants, the Rajang river basin in Sarawak, which originates in the HoB, is not only an important waterway for transport, but an important source of water supply for these dams. The capacity of forests to retain sediments is also a valuable watershed service for HEP, with sediment loads imposing significant maintenance costs on HEP facilities.

(3) Energy supply fast-tracking, currently focusing on known feasible hydropower and coal deposit sites;
(4) Human capital development acceleration within the Corridor with new learning centers and controlled immigration of skilled foreign workers;
(5) Tourism industry development, focusing on the natural attractions of the Central Region.

With coal, gas and palm oil being Sarawak's main resources, the state centers its development strategy on natural resource-related primary sectors to leverage its competitive advantage, at both national and international level, and increase government revenues. This growth strategy includes a planned expansion of the palm oil sector to two million ha of plantations by 2015. Forestry activities are important contributors to the state's finances, and Sarawak is gradually moving towards more sustainable management of these resources. Recognizing the business opportunities provided by sustainable production, a number of private companies with concessions in Sarawak have started pursuing sustainable production independently. However, SCORE has a striking potential to fragment the remaining natural forest in Sarawak, and it will need to be executed with caution in this regard[18].

Despite recent gains in GDP, various reports indicate that Sabah and Sarawak remain the poorest states in Malaysia[19]. In addition, the increased area of palm oil plantations and the strong reliance on extractive industries that feature in the states' development plans may well conflict with the pursuit of environmental goals indicated in Malaysia's national plans. Forest fragmentation, degraded ecosystems and lost or damaged ecosystem services could be among the direct impacts of implementing these plans. The resulting decline of natural capital could then become an even greater risk factor in the pursuit of continued growth.

Towards a green economy in Sabah and Sarawak

Green growth in Sabah and Sarawak would support the creation of a local engine for responsible and sustainable growth, diversifying the economy and making it less vulnerable to the volatility of commodity prices and to the performance of the global and regional economy by reducing reliance on exports.

Sabah and Sarawak naturally depend on the health and sustainability of their natural capital. A green and inclusive economy for both Sabah and Sarawak would avoid the risks of a substantial drop in growth due to depletion of this natural capital and high costs as a result of lost ecosystem services.
Despite being focused to a substantial degree on economic growth, Malaysia's short- and medium-term development plans are complemented by environmental policies designed to support the conservation of natural capital over the longer term. In addition, progress is already underway in certain sectors to transition to a greener economy. Examples include the recently introduced Feed-In Tariff (FIT) for renewable energy power generation and Sabah's commitment to a statewide REDD+ plan. Targets are available for renewable energy (5.5 per cent supply penetration by 2015 and 11 per cent by 2020), GHG emission intensity (to be reduced up to 40 per cent relative to 2005 by 2020) and energy efficiency (cumulative energy savings 4,000 Kilo tonnes of oil equivalent by 2015).

Despite efforts to improve energy efficiency and modernize capital, however, Malaysia's energy consumption continues to increase rapidly. Based on an expected decline in oil and gas output going forward, higher energy costs for households and the private sector, as well as lower revenues for the government (and potentially higher expenditures, if energy price subsidies are maintained) are to be expected. As a consequence, the potential exploitation of (cheaper) coal reserves could pose threats to Sabah and Sarawak's, as well as Kalimantan's, natural capital. A green economy strategy could support the diversification of Malaysia's energy supply, with the removal of energy price subsidies and the reallocation of investments to renewable and low-carbon sources, as well more ambitious interventions supporting energy efficiency in order to curb the projected growth of energy demand. The latter would reduce the extraction of fossil fuels for domestic use (creating more revenues through export), while reducing consumption costs and subsidies. Investments in energy efficiency and in low-carbon power supply would also actively support the GHG emission intensity reduction target set by the government, and, when coupled with sustainable land management (e.g. in Sabah and Sarawak), could bring considerable revenues through international carbon markets. Ecotourism would also benefit from such interventions, improving the income of local communities through building biodiversity-based enterprises and encouraging innovative green sectors—as well as through reduced costs associated with lost or damaged ecosystem services.

Given the continued planned increases in the area of palm oil plantations and the ongoing reliance on extractive industries, green growth in Sabah and Sarawak will require additional emphasis on the preservation of natural capital. The State of Sabah is in process of nominating the Borneo Rainforest Danum-Maliau-Imbak (DaMaI) Complex as a world heritage cluster, securing a significant area under conservation and sustainable management. The Sabah Forestry Department has also taken on 'Forever Sabah' as their green economy priority. 'Forever Sabah' is a concept that is being developed as part of an effort to transition Sabah towards a diversified green economy through institutional changes and capacity building. Resource efficiency and low carbon interventions, together with coherent ecosystem-based spatial planning, would create local employment and income and reduce operations costs for the private sector, as indicated in the analysis of integrated scenarios
(see Part III above).

A balanced approach to infrastructure expansion and sustaining natural capital is essential for an inclusive and resilient economy, as per the NEM. In this respect, green growth in Sabah and Sarawak would support the creation of a local engine for responsible and sustainable growth, diversifying the economy and making it less vulnerable to the volatility of commodity prices and to the performance of the global and regional economy by reducing reliance on exports.

4.2 A GREEN ECONOMY POLICY PACKAGE FOR SUSTAINABLE DEVELOPMENT AND CONSERVATION

What's in this chapter

- An example of an economic policy package that would sustain HoB's ecosystems and biodiversity.
- A range of economic instruments that could be employed to drive green growth in the HoB when implemented in synergy.

The previous chapter has outlined some of the important shifts in policy and practice that the HoB countries are beginning to make towards a green economy. These include land-use and emission reduction policies in Kalimantan, feed-in-tariffs for renewable energy in Malaysia and a public-private partnership for biodiversity conservation in Brunei. These examples and others offer strong evidence that progress towards a green economy has already begun.

The intention to move towards a green economy is also evident from national and sub-national planning documents, such as the low-carbon growth plans for Central and East Kalimantan, the Kalimantan Green Economy Corridor Initiative, Sabah's State-wide REDD+ plan and Green Economy Framework and Brunei's plans to diversify its economy.

While relevant sectoral policies are beginning to emerge in each of the HoB countries, a coherent, cross-sectoral green economy approach is necessary to accelerate the transition to an economy that values natural capital. Many of the economic plans described in Chapter 4.1 have been developed independently of conservation and sustainable resource management initiatives. As a result, a consistent green economy approach—one that mainstreams the ecosystem values of the HoB landscape into policy and economic decision making—is not yet the norm.

For a green economy to prosper, an enabling economic environment is necessary. Interventions from private sector and civil society actors can contribute up to a point, but if the economic environment is not conducive to green economic development, their efforts may never realize their full potential. The most essential enabler of a transition

The most essential step to transition to a green economy is overhauling the current economic infrastructure.

to a green economy is therefore an appropriate economic infrastructure. Unaccounted and untaxed externalities are at the root of behavioural trends that lead to unsustainable practices. Addressing this policy failure requires a transformation from the current economic infrastructure in terms of policy frameworks and legislation, institutions and regulations.

This chapter is based on various dialogues and workshops on green economy held over the past two years[20]. Its aim is to illustrate how a set of synergetic policy changes at national and local level can provide incentives for environmentally sustainable economic activity and tax/penalize actions that lead to environmental degradation.

A green economy policy package for the HoB

Economic, or "soft," infrastructure is built out of policies: social, economic (e.g., fiscal and monetary), etc. Though economic infrastructure also relates to institutions, the financial system, accounting standards, etc.—all of which are quite relevant—the analysis presented in this section is focused on policy.

The policy environment influences the composition of the economy through incentives and disincentives. A policy framework geared to a green economy provides positive incentives for sustainable economic behavior and penalties for activities that hinder sustainability. It promotes investments in local biodiversity-based industries, innovative green sectors and energy and resource efficiency. It avoids subsidizing harmful or destructive activities, for example clearance of natural forest for cultivation.

As policies have the potential to interact with other policies and multiple sectors, coordination at the level of design is required to ensure that policies complement one another rather that conflict. Policy drafted in isolation can lead to unintended side effects. An example of this are incentives that trigger unwanted activities or cause economic options to remain unexplored because key cross-sectoral synergies are not uncovered and maximized. For this reason, development of a 'policy package' is a desirable way to approach the green economy challenge.

Fiscal and other economic policy transformation is essential to enabling a green economic infrastructure. Economic policies, as defined in this report, refer to actions taken by a government to influence an economy. There are various types of economic policies, four of which are highlighted here: (1) voluntary behavioral change, (2) capital investment, (3) public targets mandated by law and (4) incentives such as tax reductions and subsidies. These can be used individually or in combination to influence an economy.

Reforming the economic incentives framework is the main priority and should be supported by facilitating investments in natural capital.

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The role of economic instruments in a green economy policy package

Economic policies are translated into action through economic instruments, which, in turn, incorporate environmental costs and benefits into the budgets of economic actors. The goal is to send the correct pricing signals to economic actors, i.e., contributing to environmental degradation leads to costs being imposed on the actor while contributing to environmental sustainability leads to benefits for them.

The key enabler to achieving an economy that values nature is shifting towards an economic infrastructure that provides appropriate incentives and disincentives through economic instruments. Economic instruments have immediate impacts on behaviour. They include budget reform, taxes, tax deductions, earmarked funds, temporary subsidies (through government investment programmes), fees, penalties and regulations that encourage and reward environmentally responsible behaviour. In the context of HoB, economic instruments need to be designed and implemented in pursuit of various natural capital-related goals. These include, for example:

- incentivizing biodiversity-based industries and other green sectors to secure important natural stocks;
- promoting the use of degraded land for cultivation;
- protection of key areas for provision of ecosystem goods and services and for securing viable examples of biodiversity and natural habitat, and;
- disincentivizing conversion and poor management of standing forests.

Policies are translated into action through economic instruments.

In addition to economic policy interventions implemented by governments to influence the transition described above, there are market instruments that respond more to consumer/ market behaviour rather than to government policy. While the emphasis in this chapter is on transformation of fiscal and economic policies, behavioural change on the market side is also discussed.

HoB will need to mobilize finance from domestic and international sources in order to enable economic instruments to jump-start a green economic transition. National public funds are expected to provide the main source of funding for the policy package during a transitional period. Important decisions will need to be made to eliminate perverse incentives and reallocate national and local budgets to this end. In the medium and longer term, funds can also be raised through imposing charges on 'bad' (unsustainable) behaviour.

Green policies cannot work in isolation, a policy package is necessary to make use of synergies and sharing of costs to create future benefits that will be distributed fairly.

Figure 4.4 illustrates how a package of economic policy interventions at national and sub-national levels, specific to HoB, can help to protect nature, boost green growth and build local economies. Economic policy interventions (🔴) will enable a variety of economic instruments (🔵) that will mobilize fiscal and other transfers and (dis)incentives. These economic instruments will incentivize good performances by sub-national governments, private sector and communities based on economic, social and natural capital targets and indicators.

Economic instruments are less effective when implemented in isolation; a package ensures synergies and the sharing of both costs and benefits. Such policy interventions by governments will build confidence in other actors to act and enable similar instruments, e.g. investors through share markets steer investment towards green business, consumers through market pricing, etc.

The policy package should include a variety of economic instruments targeting regional governments, private sector and communities, with sources of financing coming mostly from public funds, but also from the private sector and households (investors and users/ consumers) and with support from international finance (including REDD+ fast start finance).

These economic policies and related instruments will not work in isolation; a package is necessary to ensure synergies and to distribute costs (short-term burden), as well as to encourage a fair distribution of future benefits. The type of policy package put in place to achieve a green economy will be critical in determining the kinds of economic instruments that will be developed and the distribution of costs and benefits, i.e. who will pay and who will benefit.

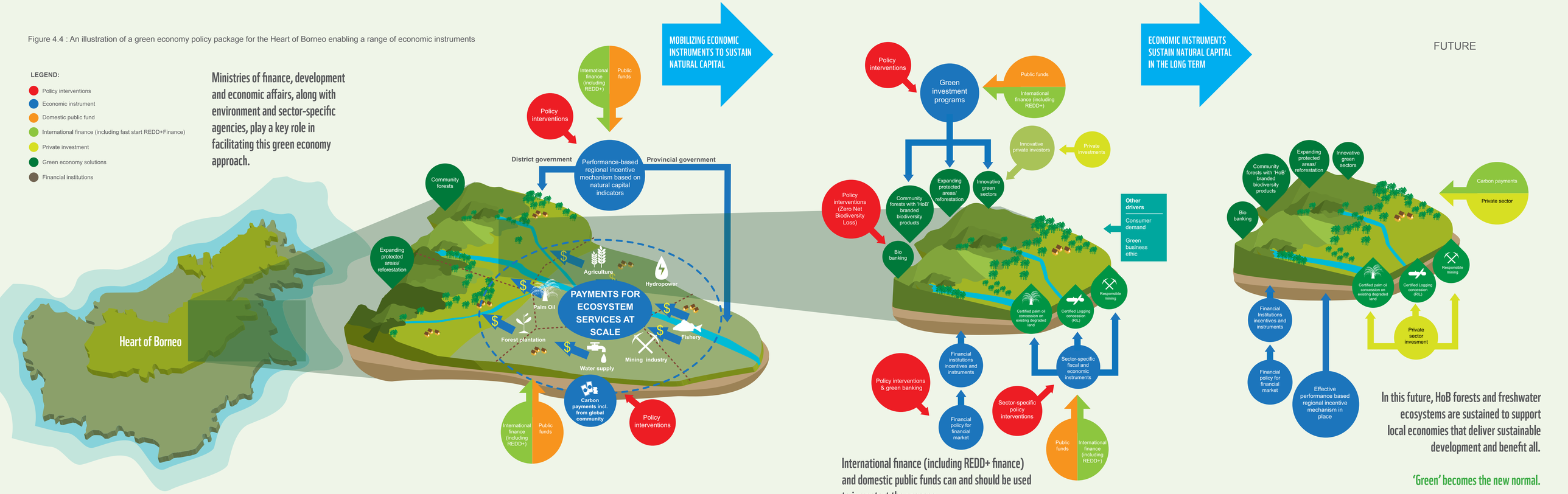
Table 4.2 below outlines various economic instruments which if implemented in synergy can help the transition towards a green economy that values natural capital. These are described in greater detail below.

Turn over this page for Figure 4.4 →

Table 4.2: Economic instruments in a green economy[21]

Type of instrument	Description	Actor(s)	Source of finance	Who benefits (directly)	Why
Public targets mandated by law					
Performance based regional incentive mechanism	Increased budget allocation to regional governments based on performance measured by natural capital indicators	National Government	National Treasury	Regional governments	To reward for securing forest cover (for biodiversity, carbon, water and soil stocks), effective monitoring and leading inclusive approaches, ecosystem-based spatial planning, cross-sectoral governance
Regulated PES at scale	Payments made by private sector and households at the level of a river basin channeled through a funding mechanism	National/ sub-national governments	Private Sector and households	Community forests/ entities managing HoB ecosystems	To reward for maintaining forests, carbon, water, soil and biodiversity stocks
No net loss legislation	Legal requirement to offset biodiversity loss from any kind of development	National Government	Developer (Private or public)	Local and global communities	To achieve a no net reduction overall of biodiversity due to anthropogenic changes to the environment
Biodiversity offsets (Biobanking)	Compensation payments for a projects' significant residual impact on biodiversity. Sectors will undertake biodiversity offsets to ensure "no net loss" in the context of their operations, and preferably a net gain.	National/ sub-national governments to set no-net loss legislation	Private sector	Set aside areas with biodiversity certificates/local communities	To achieve a no net reduction overall and preferably a net gain of biodiversity on the ground with respect to species composition, habitat structure and ecosystem function
Capital investment					
Government Investment Programs	Government injects capital into the development of biodiversity-based enterprises, innovative green sectors and support activities such as reforestation and expansion of Protected Areas. Other interventions may include support for energy efficiency.	National Government	National Treasury	Private sector and communities	To reduce pressure on deforestation and increase opportunities to generate revenue from natural stocks and ecosystem goods
Financial Institutions	Low interest financing and favorable loan arrangements to green business; tax breaks on investments; risk sharing (e.g., an MDB could share the risk of lending with a local bank or provide a first-loss facility on an investment)	National/ sub-national governments; Banks; Investors	Funds Investors	All stakeholders with business in the HoB	To boost an economy that values natural capital
International REDD+ finance	Payments to stakeholders who reduce their carbon emissions from forest areas or conserve carbon stocks, through activities such as sustainable forest management, reduced impact logging, forest restoration and conservation etc.	National/ sub national governments, Multi-lateral channels (e.g. FIP)	Donor countries (through multi or bi-lateral channels), Global funds	Stakeholders who reduce forest carbon emissions and conserve carbon stocks	To contribute towards global carbon emission reductions
Incentives and disincentives (such as tax reductions and subsidies)					
Incentives to certified logging concessions	Tax deduction, financial incentive or other forms of economic incentives to private sector: • a reduced amount of annual checks (like waiving heavy equipment license); • given allowance to export a percentage of their products directly to the export market; • given a priority for new permits to expand areas and new concessions; • paying fees (such as PSDH and DR) in accord to actual harvesting volume and not upfront.	National and regional governments	National treasury and regional budget	Logging companies	To favor certified business and make certification economically viable
Incentives to certified palm oil concessions on existing degraded land	Tax deduction, financial incentive or other forms of economic incentives to private sector: • release from land tax; • providing fertilizer subsidies to plasma farmers; • issue palm oil permit only for degraded land; • increased tariff on timber from the converted forest land to oil palm plantation; • increased income tax for palm oil plantation in forest area • taxes or charges on pollutants and wastes or other forms of economic incentives for waste/ pollution reduction	National and regional governments	National treasury and regional Budget	Palm oil Companies	To encourage palm oil development on degraded land, favor certified business and make certification economically viable
Incentives to responsible mining	Taxes or charges on pollutants and wastes or other forms of economic incentives	National and regional governments	National treasury and regional Budget	Mining companies	Incentivized for complying to required standards and criteria or penalized for breeching criteria and standards
Voluntary behavioral change					
Market Instruments	Responsible consumers and corporations demand for sustainable products has set in motion a voluntary process through which an independent third party issues a certificate guaranteeing that management of a forest/plantation is carried out according to established criteria and standards	Consumers	Consumers	Logging and palm oil companies	To encourage producers to practice sustainably

Figure 4.4 : An illustration of a green economy policy package for the Heart of Borneo enabling a range of economic instruments



Performance-based regional incentive mechanism

One potentially important instrument is a performance-based incentive mechanism to reward sub-national governments for sustaining HoB ecosystems and biodiversity. As highlighted in Busch et al. (2011)[22], land-use sectors of developing countries have decentralized land-use decision rights. Structuring a policy package with incentives in such a way that sub-national governments and stakeholders are rewarded for good monitoring and management of forests could be the start of a transition to a green economy.

With decentralized land use decision rights, performance-based incentive structures at sub-national level would encourage local governments to monitor and maintain biodiversity and ecosystems for their valuable functions and would support national governments in achieving various targets, e.g. GHG emission reduction and poverty reduction targets. Such a financial mechanism would be an effective way to reward local governments which perform well in their efforts and achievements to sustain natural capital.

Performance-based payments could be made according to aggregate indicators of outcomes, including carbon emission reduction, reduced area of deforestation or reforestation, increased number of certified concessions, policies to ensure sustainable palm oil development, participatory and coherent ecosystem-based spatial planning, active cross-sectoral governance, increased biodiversity-based and new green sectors, etc.

Regulated payment for ecosystem services (PES) at scale

As long as the value of ecosystems services goes unrecognized, there is no incentive to pay or trade anything in exchange for the services. As such, ecosystems are depleted as if there were an infinite stock. The current decline in these services is drawing attention to their importance and creating willingness to pay. When parties agree to exchange-making, these services become tradable and can be reflected in the economy.

A regulated payment for ecosystem services (PES) system at river basin scale (inter-district) can be seen as an insurance mechanism. Potential payers would not only include those with direct relation to water (such as drinking water utilities) but also sectors which use water in their processing or have an impact on water quality or quantity due to their operations. These include: coal mining companies, which use rivers for transporting barges to ports; the fishing industry, which requires a reliable and clean water supply; as well as various intermediaries and households.

For a more holistic approach, besides payments for watershed-related services from the HoB, such regulated PES could potentially include the transfer of payments for carbon credits for contributions to emission reductions. Potential payers could be the business sector or interested stakeholders within the country or from abroad (also see section below on international REDD+ finance). Tourists and tourism operators could also contribute to such PES, further encouraging community groups (with clear land tenure) who sustainably manage their ecosystems and biodiversity. Recipients of these payments would range from local community groups to best practicing businesses and investors in the HoB.

Box 4.2: Regional Incentive Fund (Dana Insentif Daerah) with natural capital-specific criteria

A performance-based Regional Incentive Fund (Dana Insentif Daerah[23]) has been in place in Indonesia since 2011, with a total value of IDR 1.4 trillion/year[24]. Incentives are provided to support regional accomplishments, with a criterion of "Fairness with Exception" towards their financial statements and their timely delivery of the Regional Budget for Revenue and Expenditure (APBD).

An incentive mechanism of a size similar to the above Regional Incentive Fund but with natural capital indicators would incentivize good governance at local level.

The main advantage of this type of mechanism is that it may be tailored according to local circumstances, with potentially different modalities according to the key ecosystem service targets to reward activities that directly improve well-being.

Potential disadvantages include the fact that the effectiveness of this payment mechanism is closely related to the capacity to objectively measure and track progress over time and to the adequacy of the economic incentives in changing behavior towards sustainability. Among others, provisions should be designed to make sure that short-term progress—and corresponding payments–does not regress into subsequent medium- and longer-term natural capital depletion without restitution of funds or extra fees.

Overall, the implementation of a performance-based incentive fund should be incorporated into a broader policy framework that includes specific sustainability, or green economy, targets. While placing a cap on the total amount available to be disbursed will not guarantee reaching stated objectives, it may be useful for the purpose of measuring and containing costs.

'No net loss' legislation

The policy requires biodiversity offsets for residual impacts on biodiversity arising from project development after appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve a no net reduction overall—and preferably a net gain—of biodiversity on the ground with respect to species composition, habitat structure and ecosystem function[25]. The policy provides a platform to reverse the overall decline in biodiversity by setting a requirement that development impacts should first of all be avoided, or, if they cannot be avoided, then they must be minimized and the residual impact should be offset. An appropriate level of emphasis can be given to avoidance to protect the most threatened biodiversity components. This approach provides a strong signal to direct development away from significant areas of biodiversity.

Sectors of extractive industries which are already legally bound to conduct environmental impact assessments and prepare related avoidance and mitigation plans can additionally ensure that their practices cause 'no net loss' in biodiversity. This can either be done by the company itself, or as in the case of conservation banks in the USA, can involve the use of tradable 'biodiversity certificates'[26] similar to the bio-bank system described in Chapter 5.1 below on 'Green Economy Solutions'.

Government investment programmes

Fiscal policy has a host of green-incentive options on which to draw in order to send out the right signals. For example, because the transformation to a green economy will require initial investment, subsidies can be put in place to encourage desirable economic activities. Governments can inject capital, through subsidies and other incentives, into solving land tenure and land titling processes, securing community forests and relieving palm oil companies of community compensation payments if they move their current concessions (on forested land) to degraded land or can partake in these processes by engaging in public-private partnerships of various kinds. The capacity and skills of communities to develop and sell 'added value' biodiversity-based products, as well to build local economies through a range of other biodiversity-based industries, can be enhanced. Besides these sectors which generate revenue from biodiversity, subsidies can also be used to stimulate innovative green sectors which create economic opportunity in waste and by-products of current sectors operating in the HoB.

Subsidizing biodiversity-based and other green interventions should go hand-in-hand with a phasing out of environmentally harmful subsidies. Businesses that fail to follow sustainable practices should not receive subsidies, access to easy credit or other forms of public support.

In light of the essential value that HoB ecosystems provide to economy and society, governments can also be encouraged to boost investment in reforestation and expansion of protected areas both to secure viable natural habitat for biodiversity and to secure the multiple ecosystem goods and services this landscape provides.

Box 4.3: Government-driven capital investment to encourage biodiversity-based sectors

In Indonesia, a government investment of approximately IDR 1.1 trillion is allocated to geothermal power generation for 2011[27]. A similar investment program is needed to encourage biodiversity-based sectors to support the transition to a greener economy.

Advantages of public capital investments include the potential to trigger private sector participation, practically facilitating the transition to a greener economy. Capital investment could reach areas when upfront costs may be too much of a deterrent for households and small entrepreneurs.

Similar to performance-based incentives, and as opposed to establishing a new mandate, a potential disadvantage is that capital investment does not ensure that specific targets would be reached. On the other hand, it allows the government to set a ceiling on capital expenditure (making the cost, or annual expenditure, foreseeable).

Financial institutions

The term 'financial institutions' covers a wide variety of actors concerned with monetary stocks and flows within the economy. These include banks (central banks, development banks, investment banks, etc.) as well as non-bank financial institutions (such as insurance companies, credit unions, etc.).

Government policy can play a significant role in influencing financial institutions by rewarding green investors with preferential tax rates on dividends and capital gains when they invest in responsible businesses (either through public stock markets or private investments in green companies).

With stronger government policies and economic infrastructure in place at local levels, financial institutions will be able to play an effective role in the transition towards a green economy. There are various ways in which financial institutions can support the shift to a green economy. These include:

- Soft financing: Financial institutions may choose to improve access to credit for certified timber industries and palm oil developers on degraded land. This could involve providing credit below market rates, offering softer terms on loans, simplifying and shortening procedures, etc. This would set an example for companies causing environmental damage to follow suit. Such lending should be accompanied by the elimination of easy credit to businesses operating unsustainably.

- Green investment strategies: Financial institutions can also use environmental standards to restrict access to credit by businesses which have not adopted green practices. Rather than considering only profitability and financial sustainability measures in the screening process to assess potential loans and investments, environmental as well as social standards can be considered. This kind of "green banking" is already developing due to market demand from individual investors who prefer banks to invest their savings in ethically appropriate projects.

- Risk mitigation by development banks: Multilateral banks can provide first loss facilities and guarantees, offer various types of insurance (e.g. political risk insurance), prepay for carbon credits etc., in order to help the private sector through the risky transition phase towards a green economy.

By providing softer credit terms such as lower interest rates, longer time frame, etc. for certified timber industries and palm oil developers on degraded land for example, behavioural change can be triggered.

Innovative financial products can aid in stimulating financial resources towards investing in a green economy.

International REDD+ finance

Safeguarding forests is a comparatively low-cost way to reduce carbon emissions while simultaneously maintaining many vital ecosystem services. The last several years have seen increased attention to the development of a mechanism for reducing emissions from deforestation and degradation, or REDD, which has the potential to be a powerful tool to achieve these goals by placing an economic value on standing forest. The REDD+ mechanism is still evolving and most current funding is coming through multilateral and bilateral channels to create the necessary conditions and infrastructure in forest countries that REDD+ requires. This 'fast start' funding currently totals a pledged amount of approximately US$7 billion[28]. Debate is on-going as to whether the much larger long-term financial flows—representing results-based payments for verified emissions reductions—will be delivered through market, market-linked or non-market means[29].

Forested landscapes such as the HoB provide the economy and society—at both local and global levels—with immense benefits. Given that conservation and sustainable development are committed goals of the three countries, allocating a portion of the fast start finance for REDD+ would support HoB governments to move ahead with their green development plans. The funds could be put to use in a variety of ways, such as through the development of the necessary institutional architecture, reform of legislation, as well as the development of economic policy packages and economic instruments described above and illustrated in Figure 4.5 and Table 4.2. This fast start finance could also be used as seed funding to initiate fiscal transfers between national and sub-national governments as well as carbon-related payment mechanisms (see section above on regulated payments for ecosystem services at scale).

Fast start REDD+ finance should be used to develop the necessary institutional architecture, reformation of legislation, as well as economic policy packages and related instruments at national and local levels, all in support of the transition to a green economy.

Fiscal incentives to green high impact sectors (logging, palm oil, mining)

In the absence of compelling economic incentives or aggressive financial penalties, industry often has no adequate incentive to change its practices. Taxes and tax deductions can aid in creating such incentives. Environmental taxes are sometimes levied on activities that are harmful to the environment, while the funds thus accrued are earmarked directly for sustainability purposes. Tax deductions can be provided to certified timber companies to help finance their investments in sustaining natural capital by practicing reduced impact logging (RIL), as well as to palm oil companies locating their businesses on degraded lands.

A combination of fiscal policies to provide incentives for, for example, the use of degraded land, along with disincentives for uses that require forest conversion, would greatly help the shift towards a greener economy. These kinds of fiscal interventions are especially useful for changing the behaviour of large businesses, but need to be coupled with other measures, e.g. full pricing of environmental impacts. In this way, governments will balance expenditures: gaining more at the beginning—from uncertified businesses or those that develop palm oil on forested land—and contributing more to green companies later on.

Market instruments

Consumer pressure can play a significant role in driving behavioural change by generating increased demand for sustainable products and reducing demand for unsustainable ones. The resulting signals encourage consumer goods manufacturers to adopt sustainable sourcing policies in order to maintain their customer base and market share.

In addition to direct pressure from consumers, corporations are facing increased pressure from the public and from their shareholders to behave responsibly towards their stakeholders and to be responsible stewards of the environment. This trend has led to the corporate social responsibility (CSR) concept. Indeed, for some companies, CSR has evolved into a deeper and more comprehensive adoption of sustainability as a core strategy. As more companies see sustainability and good environmental stewardship as part of their core strategy, and as more consumers vote with their wallets for sustainably produced goods, support for a greener and more sustainable economy will increase.

Certification of source materials such as palm oil and timber is one way to formalize and institutionalize the criteria and guidelines for sustainable products. Certification of timber and palm oil is a voluntary process through which an independent third party issues a certificate confirming that the management of a forest or plantation is being carried out according to a set of established criteria and standards that take into account environmental and social impacts. Crude palm oil produced in accordance with such criteria and standards (including use of degraded land) is sometimes awarded a (small) price premium in the market. Companies like Wal-Mart and The Body Shop encourage such initiatives. Under the current global regulatory framework, demand for sustainable oil palm products is insufficient to result in a price premium sufficient to cover the additional costs of certification. However, increasing consumer awareness of certification programmes can help to raise such premiums. In addition, government policies that allow for lower export and import tariffs for sustainably

sourced materials can provide additional incentives to producers. This will help producer companies see additional value in certification of their production and hence swing the cost-benefit analysis towards certification. However, even with additional market push for certified products, without an economic infrastructure that favours 'green' business, consumer-driven market signals alone will not be sufficient to make it economically viable for many 'conventional' commodity sectors to go green.

Actions in the HoB have already begun to demonstrate the tangible and successful application of certification schemes. As of 2012, the HoB had over one million hectares under Forest Stewardship Council (FSC) certification, with additional areas at various stages of the certification process. Over time, stronger law enforcement, penalties, implementation of a range of fiscal incentives and a performance-based increase in budget allocation to local governments will help to create an investment climate that encourages the private sector to engage in certification, even as clear laws and fiscal incentives reduce the costs of such processes.

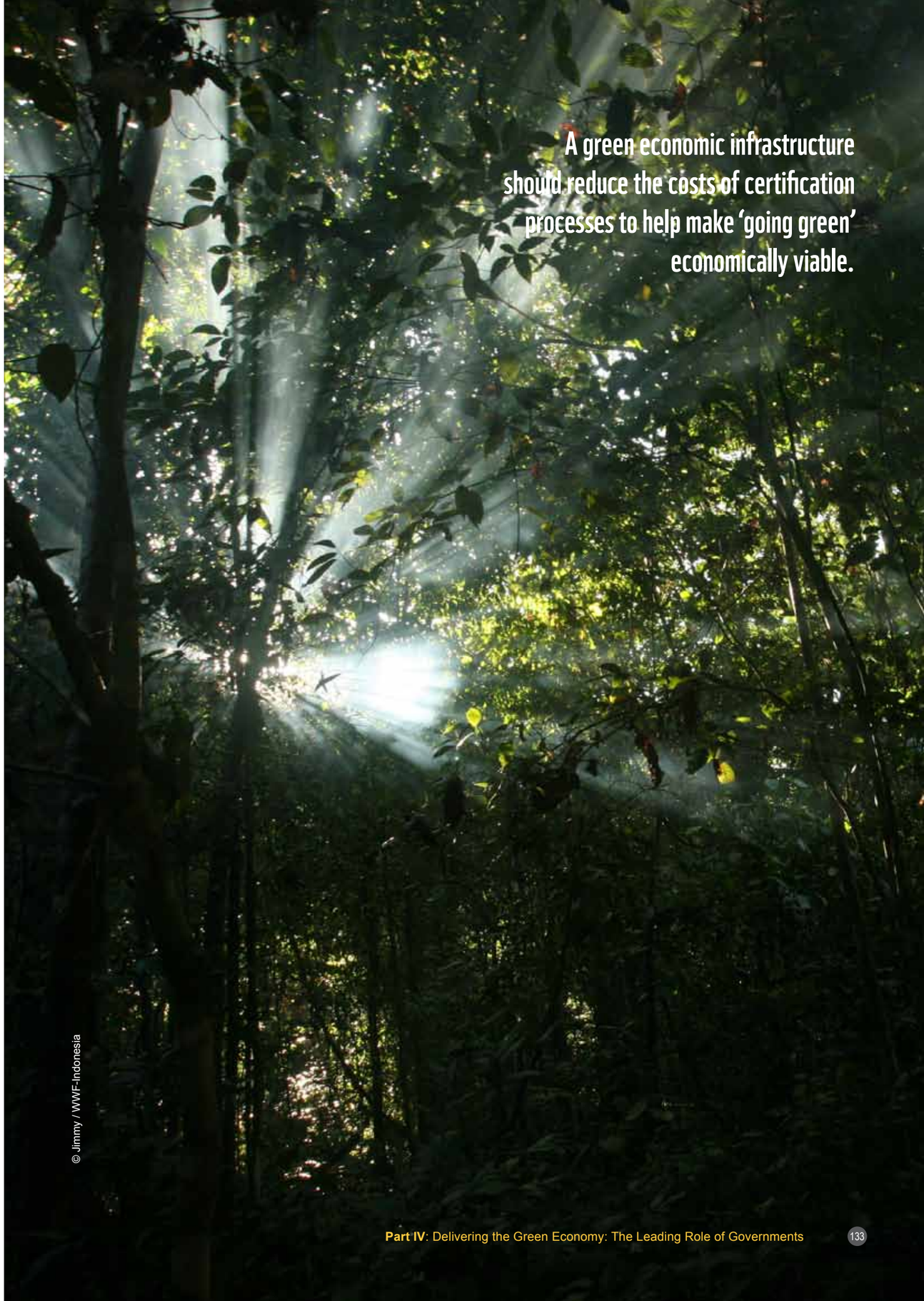
The above examples illustrate some key elements of a policy package and their related economic instruments which can encourage biodiversity-based sectors and innovative green sectors to flourish, and support high-impact production sectors to transition to greener practices, while spelling out how protecting HoB's natural capital can be supported through fiscal transfer mechanisms and other economic instruments. These include each of the key areas outlined in the introduction, i.e. public targets mandated by law, capital investment, incentives and voluntary behavioural change. Regulations need to be designed to improve green competitiveness. As discussed above, governments have a critical role to play through investments (including subsidy reform), mandates and other incentives aimed at supporting behavioural change.

Since targets and mandates ensure reaching stated goals while controlling expenditure, and incentives as well as capital investments support cost sharing across the key actors in the economy, creating a comprehensive package would allow making the best of all the options analyzed. The policy package proposed in this study would therefore include mandates, indicators and targets related to, for example, natural capital conservation and ecosystem services restoration, as well as incentives to encourage capital investments in areas like renewable energy and biodiversity-based enterprises. (see Part V, Chapter 5.1).

While transitioning to remove current perverse incentives, simultaneously funding for a proposed policy package could be raised through imposing a charge on unsustainable behaviour, while incentives would reallocate this extra revenue through performance-based mechanisms. Public-private partnerships can also further this cause. Considering that a green economy would reduce infrastructure costs without significantly affecting the profitability of the private sector, which would in any case likely benefit from favourable market pricing of the goods produced, the transition could take place smoothly—assuming it were effectively managed.

There are many other instruments not discussed above, including economic policies relevant to international trade (e.g. tariffs and other trade barriers). Conventional ways of financing conservation initiatives have typically consisted of special funds, soft loans or credit on favourable terms. Donors, governments and the private sector have historically stuck to such conventional funding mechanisms. Other instruments used are, for example, tourism levies and user fees for national parks. Many "new kinds" of funding mechanisms have been explored, from micro finance to bilateral debt reduction. One well-known recent example for the HoB is the debt-for-nature-swap, whereby debt owned by the government of Indonesia to the US Government (over US$28 million) was written off on the basis of a commitment to protect two regions in the Kalimantan part of the HoB. This debt reduction can now be channeled to fund the protection of Borneo's forests[30].

Effective economic instruments, alongside strong law enforcement and clear land tenure, will create a 'green' investment climate—one that encourages the private sector to engage in certification and payment mechanisms and rewards sub-national governments and communities for good stewardship. Most costs can be repaid by a more sustainable and inclusive local economy. Local biodiversity-based and innovative green sectors can cover their start-up costs and conventional private sector actors will reap the benefits of 'going green'.



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Visualizing the impacts of a green economy policy package

A green economy policy package—including effective use of economic instruments and aimed at conserving and restoring natural capital—has tremendous potential to protect ecosystem services to the benefit of Borneo's economy and society, as well as global stakeholders. Figure 4.4(a) and (b) below illustrate the kinds of changes that could be expected to take place.

Figure 4.5 (a) shows the current economy, where poor ecosystem management continues, including clearing of forested land with valuable biodiversity and ecosystems due to lucrative financial returns for palm oil and unsustainable mineral exploitation. As a result, society, other sectors and local governments pay the price of water pollution, dredging of rivers, infrastructure repair due to flooding and loss of income due to degraded fisheries and forests. As discussed in previous chapters, externalizing costs in the pursuit of short-term private profits is thus often directly or indirectly linked to public losses and loss of profit from other sectors in the area.

Figure 4.5a: Impacts on Borneo's economy and society in an economy which does not value natural capital

Figure 4.5 (b), in contrast, illustrates elements of a green economy which values and maintains natural capital in the interest of long-term, inclusive growth. Such an economy enhances the provision of goods for revenue generation opportunities and avoids costs associated with damaged ecosystem services. Better protection and management of natural capital, in the medium to long term, generates more biodiversity-based revenue flows, secures more natural stocks for future use and avoids unnecessary costs related to damaged ecosystem services (Figure 4.5b). As described in the modeling analysis, this results in higher (conventional) GDP, especially green GDP (which accounts for natural capital).

Figure 4.5b: Impacts on Borneo's economy and society in a green economy which values natural capital

4.3 GREEN GROWTH AND NATURAL CAPITAL INDICATORS AND TARGETS

What's in this chapter

- Proposed targets and indicators for measuring success in transitioning to a green economy.

Today's economy depends too much on traditional measures of progress like GDP growth. As an alternative, economic, social and natural capital indicators in the HoB could be linked to spatially explicit targets associated with spatial plans. While extensive work has been done on sustainable development indicators, a single, widely agreed method for measuring social and environmental development has yet to emerge.

A set of measurable indicators and targets would help to demonstrate whether and to what extent specific initiatives were contributing to green economic development in the three countries. Indicators and targets would highlight the potential for the HoB Initiative to contribute to the achievement of national government goals on GHG emissions reduction, poverty reduction, water management and energy and food security.

In designing a performance framework for the HoB, the benchmark would need to be set against international good practice related to green growth. The benchmarking framework would address key performance measures at the level of both the vision, i.e. green growth outcomes, as well as at the level of the institutional structures and interventions established to help deliver the vision. Not only indicators of environmental change but also economic indicators need to be included. This marks a departure from common measures of sustainable development, which tend to focus on the environmental impact of economic activity rather than on the economic importance of natural capital[31].

Green growth indicators could include but not be limited to the following:

Economic development:

- Economic performance and employment creation for biodiversity-based and new green sectors, to leverage the increased quality and availability of natural capital;
- Economic growth rates for the creation of a stronger local economy, in order to reduce vulnerability to commodity price volatility and foreign markets (supported by the more localized nature of value added, not destined to exports).

Poverty reduction:

- Income distribution and poverty assessments, to highlight equity implications, explicitly accounting for the role of natural capital in the creation of income for the rural population (primarily through ecosystem goods) and urban population (primarily through ecosystem services).

Natural capital indicators could include but not be limited to the following:

Natural capital and ecosystem resilience:

- Enhanced stocks and flows of natural capital;
- Improved use of river transportation and water availability, through more sustainable management of ecological infrastructure (directly affecting sedimentation and water availability) and reducing built infrastructure costs;
- Reduced flood events through better management of natural capital to reduce sedimentation as runoff, which in turn would lower relief and infrastructure expenditures;
- Access to potable water and sanitation, by lowering runoff and saltwater intrusion, as well as regulating the use of chemical fertilizers and pesticides;
- Various biodiversity-related indicators, both species- and ecosystem-based, to measure ecosystem health and natural capital's inputs to ecotourism, bio-banking, bio-prospecting and other emerging sectors.

GHG emission reduction:

- Increased supply of renewable energy (including hydro and other renewables) to increase access to power, improve reliability of electricity supply and reduce fossil fuel consumption;
- Improved energy and resource efficiency, to lower costs and conserve reserves and resources (for future consumption or exports);
- GHG emissions reduction targets, absolute or as intensity (i.e., GHG per unit of GDP) for both fossil fuels and natural sinks;
- Measurement, reporting and verification (MRV) systems for REDD+.

There is a need to develop financing mechanisms with natural capital indicators which direct public funds based on performance in emission reduction, poverty reduction,certification etc.

At the level of the HoB vision, spatially explicit targets at the landscape level could be set for these indicators over the short-, medium- and long-term horizons. Examples of such measurable targets are provided below.

(1) Effective management of __ha (__% of HoB) consisting of national parks, other conservation and restricted areas;
(2) Expand and improve connectivity between protected areas covering an area of __ ha;
(3) Secure at least __ ha for its essential watershed services to support more than 70% of the island of Borneo for the benefit of key economic sectors and for over 11 million people;
(4) Secure at least _____ ha (___ % of HoB) under Sustainable Forest Management of which __ha under FSC certification;
(5) Ensure that all existing palm oil (__ ha – __ % of HoB) is under responsible palm oil cultivation, independently certified and prioritizing degraded lands;
(6) Refrain from further conversion of natural forests to other land use;
(7) Secure __ Gt of carbon through a mosaic of different land uses and avoid at least __ CO_2 emissions in support of national emission reduction targets;
(8) Restore at least __ ha of degraded forests (__% of HoB).

Note: Quantities are deliberately left blank in this example, the purpose of which is to give an idea of the kinds of quantitative indicators that could be used rather than to propose specific figures.

This list of indicators and targets should be considered as a starting point to stimulate a debate, also considering that various approaches to the monitoring of green growth and natural capital are currently being developed by organizations worldwide and there is currently no standard or template formally approved at the international level. Nevertheless, especially in the HoB, there is an urgent need to improve development plans by fully incorporating the role of natural capital in policy making. Performance-based fiscal and other forms of economic instruments can further encourage good governance and best practices by large and small holders in the HoB. The above indicators and targets are aimed supporting this process of mainstreaming natural capital and green growth.

4.4 OTHER ENABLING ROLES OF GOVERNMENTS

What's in this chapter

- The broader, enabling role of governments beyond the development of economic policies.

As shown throughout Part IV, delivering a green economy requires a wide range of policies and economic instruments. A cross-sectoral economic policy package is a necessary, but not a sufficient, step in encouraging a green economy. There are limitations in governments' ability to modify fiscal regimes, given that Borneo's economy is closely integrated with national and global economies.

Governments could take the following additional steps to develop a suitable enabling environment to encourage a green economy to take root:

Institute regulations which mandate the accounting of natural capital throughout all economic sectors: While central to measuring sustainable growth, natural capital has not been explicitly quantified in economic models and accounting frameworks. Natural capital values need to be systematically integrated into national accounts and into macroeconomic indicators that monitor development progress and resource management.

Ensure that land tenure and property rights are addressed: This is one important task that can only be undertaken by governments. Greater land tenure security, including greater clarity on forest carbon assets and rights, has positive economic implications. It reduces uncertainty and generates incentives to improve natural capital management by increasing the likelihood that communities will retain and enjoy more economic benefits for their labor and time in managing natural capital. Greater recognition of community forest management and ownership will significantly incentivize the sustainable management of natural capital[32].

Governments play an indispensable role in creating an environment conducive to a green economy, in terms of establishing the policy and institutional framework and incentivizing behavior that recognizes the value of natural capital.

Devise transparent and accountable procedures to facilitate a green economy: This requires financing mechanisms based on natural capital indicators which direct public funds towards targeted stakeholders based on performance in achieving measurable targets—emissions reduction, certification, poverty reduction, etc. Effective monitoring and verification capacities are additional essential elements.

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END NOTES PART IV

[1] See below and Part I for details on the HoB Initiative.

[2] Government of Brunei Darussalam, Government of Indonesia and Government of Malaysia. 2010. *Financing the Heart of Borneo, A partnerships approach to economic sustainability.*

[3] Ministry of Industry & Primary Resources (Government of Brunei Darussalam). 2008. *Heart of Borneo Project Implementation Framework Negara Brunei Darussalam*.

[4] *Ibid.*

[5] Revenues from crude oil and natural gas production account for over 65 per cent of GDP and more than 90 per cent of total exports. Source: Department of Economic Planning and Development Prime minister's Office (Government of Brunei Darussalam). 2012. *Brunei Economic Bulletin, Volume 9 Issue 2, Second Half 2011 (H2 2011) Economic Developments*

[6] Anderson and Marsden. 1984. Brunei Forest Resources and Strategic Planning Study: Not published.

[7] Davies, J. 2011. *The Estimated Carbon Store, Carbon Emissions and Sequestration Capacity in Brunei Peatlands*. Report under the project An Action Plan for the Peatlands within the "Heart Of Borneo" Area in the Context of Rehabilitating Degraded Peatlands and Reducing $C0_2$ Emissions.

[8] Hooijer*et al.* 2010. Current and future CO2 emissions from drained Peatlands in Southeast Asia.*Biogeosciences - An Interactive Open Access Journal of the European Geosciences Union,*

[9] Census (Indonesia). 2010.

[10] Ministry for Economic Affairs, Republic of Indonesia. 2011. *Master plan for acceleration and Expansion of Indonesia Economic Development 2011-2025*, , pp.98-114.

[11] Peraturan Presiden No. 61. 2011. Tentang Rencana Aksi Nasional Penurunan Emisi Gas Rumah Kaca (RAN-GRK).

[12] Ministry of Environment, Indonesia Second National Communication. 2010. UNFCCC.

[13] Letter of Intent between the Government of the Kingdom of Norway and the Government of the Republic of Indonesia on reducing greenhouse gas emissions from deforestation and forest degradation. 26 May 2010. http://www.forestsclimatechange.org/fileadmin/photos/Norway-Indonesia-LoI.pdf

[14] Heart of Borneo National Working Group. 2010. *Indonesia Heart of Borneo Strategic Plan of Action*.

[15] Note: The Federal Government receives 95 per cent of the oil and gas income while Sarawak captures 5 per cent.

[16] Starling Resources and WWF. 2010. *Feasibility Assessment: Financing the Heart of Borneo Landscape. Technical Report.*

[17] In 2009, Sabah alone recorded more than 2 million arrivals, generating an estimated US$1.2 billion in tourism receipts (or approximately 10 per cent of GDP, although tourism value added would be much lower than this percentage), partly connected to Sabah's quality of the natural environment. Source: Oxford Business Group. 2011. *The report: Sabah. 2011.*

[18] Lessons can be drawn from Malaysia's mainland: ERE. 2009. *Central Forest Spine 1: a Master Plan for Ecological Linkages, Final Report*. Federal Department of Town & Country Planning, Peninsular Malaysia.

[19] World Bank. 2010. *Malaysia Economic Monitor.*

[20] See ANNEX I for the Heart of Borneo Green Economy Stakeholder Engagement Process.

[21] Many of these instruments share common enabling conditions, required for effective implementation, such as addressing tenure rights, effective spatial planning on landscape basis, effective law enforcement, solving conflicting interests /political agendas, etc. These conditions would be best analyzed in country specific studies (see chapter 5.3 Critical steps to success).

[22] Busch *et al*. 2011. Structuring economic incentives to reduce emissions from deforestation within Indonesia. PNAS Early Edition. pnas.org/lookup/suppl/doi:10. 1073/pnas.1109034109/-/DCSupplemental.

[23] Undang Undang Republik Indonesia No 10.2010. *Anggaran Pendapatan dan Belanja Negara 2011*.

[24] Peraturan Menteri Keuangan No. 61. 2011. *Pedoman Umum Alokasi Dana Insentif Daerah Tahun Anggaran 2011*.

[25] Business and Biodiversity Offsets Programme, website: http://bbop.forest-trends.org/index.php.

[26] Marsden, Carroll, Moore Brands. 2010, *State of Biodiversity Markets Report: Offset and Compensation Programs Worldwide*.

[27] Nota Keuangan dan Anggaran Pendapatan dan Belanja Negara Republik Indonesia 2011.

[28] Ardot, M. S. 2010. *Analysis of REDD+ financing gaps and overlaps*. REDD+ Partnership. http://reddpluspartnership.org/25159-09eb378a8444ec149e8ab32e2f5671b11.pdf.

[29] See chapter 4.1 for HoB country-specific developments related to REDD+.

[30] http://www.worldwildlife.org/what/howwedoit/conservationfinance/debtfornatureswaps.html .

[31] ISHES. 2012. *Life beyond growth - Alternatives and Complements to GDP-Measured Growth as a Framing Concept for Social Progress.*

[32] The Government of Indonesia has taken a bold step to undertake a thorough land reform which would provide tenure security for local and indigenous communities to foster the sustainable management of forests. See Keynote speech at *International Conference on Forest Tenure, Governance and Enterprise*, Lombok 12 July 2011.

PART V:
WORKING TOGETHER TO BUILD A GREEN ECONOMY

Part V:

Working Together to Build a Green Economy

Overview

The final part of the report goes beyond the role of government to discuss a wide range of solutions and actions that need to be taken by various stakeholders.

Chapter 5.1 discusses on-the-ground and cross-cutting solutions, including specific investments and other actions meant to enhance natural capital. It presents a mix of possible actions by various stakeholders.

Chapter 5.2 sets out potential roles of key stakeholder groups, including business, civil society, the global community and media.

Chapter 5.3 describes a way forward, presenting a series of critical next steps for success based on five success factors and aligned with the priorities contained in the three-country action plan.

Chapter 5.4 concludes the report, noting that a carefully constructed roadmap would help to facilitate the joint efforts of the three HoB countries to advance to a green economy.

Throughout 2011 and 2012, stakeholder consultations and workshops were held to explore the potential for, and local views on, a green economy in Borneo and HoB's potential role. Potential on-the-ground green economy (GE) solutions were identified, which would direct all stakeholders towards an economy that values natural capital, reduces poverty and builds local economies. Many of these solutions are already starting to emerge, but not yet at scale.

FIGURES

TABLES

BOXES

5.1 GREEN ECONOMY SOLUTIONS

What's in this chapter

- On-the-ground and cross-cutting solutions
- Specific investments and other actions meant to enhance natural capital
- Possible actions by various stakeholders

Part IV discussed the role of governments and in particular the use of economic policy to enable instruments capable of helping to shift the economy to one that values natural capital. However, a green economy will not emerge through the efforts of governments alone. A wide range of stakeholders each has a role to play in accelerating the transition to a green economy.

Part V therefore presents a variety of on-the-ground solutions which can be part of a mosaic of land uses in the HoB, all in different ways contributing to sustaining natural capital. In doing so, it highlights the roles of other, non-governmental stakeholders along with some critical next steps needed to realize the HoB Vision.

Throughout 2011 and ongoing in 2012, workshops[1] were held and stakeholders engaged as part of a process of exploring the potential for, and local views on, a green economy in Borneo and the HoB's role therein. These participatory processes have helped to identify potential on-the-ground solutions which would direct government, business and all stakeholders towards an economy that values natural capital, reduces poverty and builds local economies. Many of these solutions are already starting to emerge, while others are just beginning to gather momentum.

This chapter presents these on-the-ground solutions; some are sector specific and aimed at building local revenue, generating a more inclusive distribution of benefits and reducing pressures to deforest. Others are cross-cutting and essential to avoiding costs related to depletion of natural capital, including damaged ecosystem services in particular.

A summary of these solutions is presented below. Figure 5.1 illustrates the impacts of these solutions. Examples of each type of solution are presented in tables and in the remaining sections of this chapter.

Figure 5.1: Positive impacts of green economy solutions

SECTOR-SPECIFIC GREEN ECONOMY SOLUTIONS

Biodiversity-based enterprises run by community-managed areas
Communities are directly involved in marketing biodiversity-based (including agroforestry) products, thereby building local economies, alleviating poverty and reducing pressures to deforest. Examples include honey, gaharu,'Banuaka' beads, medicinal plants, fish, cocoa and adan rice.

Future biodiversity-based business
This involves market-based mechanisms that recognize natural capital as an asset, thereby creating financial value. Examples include bio-banking, bio-prospecting and ecosystem restoration as a commercial service.

Transboundary ecotourism
An integrated strategy for HoB cross-border ecotourism would enhance biodiversity and local livelihoods while helping to sustain Dayak culture.

Innovative green sectors
This includes green energy such as micro-hydro power and technologies which turn waste into raw materials for generating energy or other useful products (e.g. processing of palm oil effluent to energy).

Greening high-impact sectors
Large-scale, high-impact sectors, including logging, palm oil cultivation and mining, require a range of investments to enhance their sustainability (including land swaps). These efforts need to be supported through incentives for following certification processes and internationally recognized sustainability standards and through penalties for unsustainable practices.

CROSS-CUTTING GREEN ECONOMY SOLUTIONS

The following are essential interventions across the landscape which require a collaborative approach among sectors:

Participatory ecosystem-based spatial planning
This tool for landscape management uses ecosystem boundaries as the delineating factor rather than district, state or other administrative boundaries. Developed in a participatory way, the approach aims at the harmonious coexistence of all living organisms—humans, plants, animals and microorganisms—together with the abiotic environment.

Integrated watershed management
This approach promotes the coordinated development and management of water, land and related resources in a watershed in order to maximize economic and social welfare and equity without compromising the sustainability of vital ecosystems and the environment.

Expanding protected areas networks and improving connectivity
Effective management as well as increasing the size of protected areas and enhancing their connectivity helps to preserve their ecological integrity for enhanced flow of ecosystem services while facilitating gene flow and building resilience in a changing climate.

Building a biodiversity-based sector

A biodiversity-based sector of the economy is defined here as consisting of businesses and other economic activities[2] that either depend on biodiversity for their core business or that contribute to biodiversity conservation through their activities. This particular solution focuses on how communities and entrepreneurs can support biodiversity conservation, alleviate poverty and reduce pressures to deforest while contributing to sustainable development of the local economy.

Many biodiversity-based enterprises are run by communities, which are able to access raw materials or products from community-managed lands. Typical products include ecosystem goods such as non-timber forest products (NTFP) and agro-forestry products. In Borneo this includes forest honey, gaharu, aloe vera products, 'banuaka beads', medicinal plants, fisheries (ornamental fish and fish for consumption), cocoa and adan rice. Three of these community-managed products—gaharu inoculation and cultivation, certification of cocoa agro-forest producers and the Tagal system & cage aquaculture for empurau fish—are described in the tables that follow, along with one service—community-based ecotourism. In the case of the latter, particular emphasis is placed on the potential for trans-boundary ecotourism, an integrated strategy for which would enhance biodiversity and local livelihoods while helping to sustain local Dayak culture.

Also presented in the tables below is a related category of enterprises referred to here as 'future biodiversity-based businesses'. Those presented here are: ecosystem restoration services, protecting and restoring abandoned logging concessions, bio-banking and bioprospecting. While some of these businesses have already begun to emerge in the HoB, in order for them truly to flourish, existing barriers, such as lack of entrepreneurial capacity, perverse incentives currently in place for unsustainable businesses, lack of recognition of tenure rights of indigenous peoples, conflicting regulations, etc. need to be overcome.

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Biodiversity-based products from community-managed areas

Community gaharu inoculation and cultivation[3]	
Description	Gaharu, also known as agarwood, aloeswood or eaglewood, is wood from the *Aquilaria* tree that is infected by a fungus, giving it a slight scent. This wood can be sold as a product of high commercial value for its use in religious, medicinal and aromatic preparations. Community gaharu agroforestry is the small-scale and environmentally sustainable production of agarwood by local communities.
What is the issue?	The gaharu industry is a viable and high-income industry with strong demand from the Middle East and more recently, China. High demand has led to unsustainable harvesting practices to the point of extinction of the species. Gaharu is only found in a small percentage of Aquilaria trees from the species known to produce it. Due to the difficulties in identifying which is a gaharu producing tree, trees are often felled and split open indiscriminately. Community gaharu agroforestry initiatives can lead to more sustainable exploitation of gaharu-producing trees.
Who is the seller?	Community groups (farmers' gaharu cultivators' association) with clear responsibility to conserve and sustainably manage a dedicated forested area.
Who is the buyer?	Capacity to process gaharu into essential oil (equipment and financial capital) could be built within the community groups, as long as there isa reliable power source for distilling. The trade chain could be made much shorter for more benefits retained at the source.
Steps towards successful business model:	• Development of technologies and methods for the selection of species according to soil and weather conditions, potential for resinproduction (i.e. fungus infected wood fiber) and environmentally sustainability; • Identify suitable growing areas; • Build capacity of local people in terms of business skills and production skills; • Improve access to (affordable) technology; • Multi-stakeholder planning process involving research institutions, government agencies and communities for sustainable gaharu production methods and practices; • Develop product marketing strategies which encourage the uptake of sustainably produced gaharu e.g. through systems such as green product labeling.
What can banks do:	Banks and other financial institution (e.g. credit unions, cooperatives) can offer microfinance, with simplified lending requirements for such entrepreneurial communities
What can the private sector do?	• Support and promote the purchase of sustainably-produced gaharu; • Promote/support local development of gaharu oil refining industry.
What can the Government do?	National: • Ensure land tenure and property rights are addressed; • Enforce CITES permits for production, import and export of gaharu products allowing for sustainably sourced/produced gaharu embedded within the approval process. Local: • Build capacity of the local community in gaharu production methods; • Establish local institutions to support business knowledge of local communities; • Develop agricultural land use plans at the local level, including identification of areas suitable for community-based gaharu agroforestry; • Provide subsidies and financial assistance for seedlings and inoculation.
Contribution to...	• Securing natural capital: Intensification of existing land use, e.g., old rubber plantations, fruit orchards to generate additional income while avoiding expansion of agricultural lands. • Poverty reduction: Community gaharu agroforestry can be used for income generation. • Economic growth: Builds local economies and helps diversify from timber and oil palm. • Climate change mitigation / adaptation: Increases biomass for the uptake of carbon and contributes to prevention of deforestation; enhances biodiversity, which builds ecosystem resilience in a changing climate.

Certification of cocoa agro-forest producers[4]	
Description	A certification system for sustainable and biodiversity-friendly cocoa production can provide economic opportunities while contributing to biodiversity conservation and stabilization of deforestation frontiers. Certification takes place at the firm level; certification criteria consist of management practices which are partly landscape dependent.
What is the issue?	Cocoa production has contributed to deforestation and biodiversity loss in many tropical countries. By using more sustainable farming practices such as an agro-forest system, cocoa can instead play a positive role in protecting biodiversity and ecosystems. Though cocoa agro-forests cannot match the biodiversity level of primary forests, biodiversity in cocoa agro-forests is higher than in most other agricultural landscapes. Cocoa can be used to partially reforest degraded agricultural lands, improve habitat connectivity for wildlife and stabilize and provide livelihoods to communities living within buffer zones around protected areas.
Who is the seller?	Cocoa farmers, cooperatives, companies
Who is the buyer?	Companies, middlemen
Steps towards successful business model:	• Identification of 'intact cocoa landscape' (proposed by organization or coalition of farmers); • For each landscape, site-level certification criteria are determined by a committee of local stakeholders with the advice of a global steering committee; • In each landscape, farmers produce cocoa according to the criteria; • Audit by trained local organizations, overseen by international steering committee; • Successfully audited farms can sell produce as certified 'biodiversity-friendly cocoa'.
What can banks do:	• Simplify lending requirements for sustainable entrepreneurs/farmers or offer microfinance; • Investors can favor certified companies/farmers.
What can the private sector do?	• Engage in long term sub-contracting arrangements with certified farmers/companies; • Adopt green procurement practices to buy certified cocoa only.
What can the Government do?	National: • Ensure land tenure and property rights are addressed; • Ensure capacity and authority of institutions for sustainable land management; • Ensure protected area management does not conflict with restoration initiatives; • Ensure agricultural and macroeconomic policies encourage biodiversity-friendly farming; • Ensure agricultural R&D and extension services have capacity to promote. Local: • Favour (certified) agro-forestry initiatives for ecosystem restoration when providing concessions.
Contribution to...	• Securing natural capital: Local and sustainable agro-forestry practices ensure ecosystems and biodiversity are sustained. • Poverty reduction: Enhances income, provides higher profit margin than uncertified cocoa. • Economic growth: Strengthens and diversifies local economy; greater proportion of the economic benefit is retained in the local communities[5]. • Climate change: Contributes to climate change mitigation by providing an alternative income source (rather than livelihoods based on deforestation and/or forest degradation); enhances/ maintains biodiversity which builds resilience against the impacts of climate change.

Tagal system & cage aquaculture for empurau fish[6]	
What is the issue?	Large scale commercial and intensified aquaculture causes organic sedimentation built up, reduced level of dissolved oxygen content, changes in biodiversity and an overall unhealthy ecosystem of the waters due to its high-input, high-output nutrient to the environment. However, aquaculture is being relied on to provide the increasing demand for fish supply, including the supply for empurau. Best aquaculture practices are needed to ensure long term sustainability of river fishes for aquaculture and alternatives income for local communities.
Who is the seller?	Businesses/Community
Who is the buyer?	Businesses
Steps towards successful business model:	• Comprehensive environmental impact assessment; • Identify suitable locations for development of empurau Tagal system; • Monitor the carrying capacity of river systems used for aquaculture and establish project approval and licensing systems which integrate an assessment of the carrying capacity; • Invest in research and development of sustainable freshwater aquaculture systems which build on enrichment of the natural surroundings to create pristine water conditions; • Invest in capacity building and support empowerment of local people and the Tagal system; • Design a system that distributes economic returns fairly among stakeholders and where returns are also invested back into management and enrichment of freshwater resources; • Introduce financing mechanisms enabling a percentage of profits to be channeled back to improvement of water quality and habitat restoration in the river basins; • Design a system that distributes economic returns fairly among stakeholders within the affected river system.
What can banks do:	• Banks and other financial institution (e.g. credit unions, cooperatives) can offer microfinance, provide the impetus for a greater integrated plan that includes an assessment of environmental and social risks.
What can the private sector do?	• Use and develop local community capacities in the industry; • Support the tagal system by working closely with the local communities.
What can the Government do?	Local: • Establish aquaculture standards including best management practices for the industry; • Build local capacity for establishment of tagal systems in targeted pristine river systems; • Create a framework or structure for multi-stakeholder and integrated water resources and land-use planning and management; • Invest in technology development, database development and establish ecological monitoring systems; • Promote tagal system areas for ecotourism.
Contribution to...	• Securing natural capital: The pristine river water required to be maintained for the survival of the empurau fish will promote conservation of the river system and its surrounding areas. • Poverty reduction: Empurau aquaculture and tagal system generates income for local communities. • Economic growth: Builds local economies and increased value from pristine freshwater resources. • Climate change: Reduce destruction of mangrove and ecosystems by reducing reliance on coastal aquaculture industry.

Community-based ecotourism	
What is the issue?	Community-based ecotourism can develop into a sustainable conservation-based enterprise, but in order to deliver on its promise, conditions must be created under which communities can exercise control over the kind and intensity of tourism, retain autonomy, and develop tourism in accordance with their own vision of the future and the needs of environmental conservation. Local people should be in a position to benefit from revenues of ecotourism, and to control ecotourism development to minimize negative impacts on their territory, culture, and society. In the HoB, cultural, nature and adventure tourism have a great deal of potential. Moreover, HoB offers the unique 'feature' of transboundary ecotourism between Malaysia and Indonesia, which BIMP-EAGA has already identified. Viable examples of private-community partnerships have been developed in pilot project areas (Kapuas Hulu in Kalimantan Barat and in the Krayan Highlands, Nunukan, Kalimantan Timur).
Who is the seller?	Businesses / communities
Who is the buyer?	Tourists / tour operators
Steps towards successful business model:	• Comprehensive environmental and social impact analysis; • International cooperation in terms of flights, roads, border-crossing, three-country travel pass, tourism infrastructure development and other supporting factors; • Multi-stakeholder planning process (local government, communities, operators); • Design a system that distributes economic returns fairly among all stakeholders; • Create economic benefits from conservation for local stakeholders; • Strengthen local community organizations and local business operators; • Invest in capacity building, support cultural revival and empowerment of local people; • Establish community ecotourism concessions with long-term management licenses.
What can banks do:	Banks and other financial institution (e.g. credit unions, cooperatives) can offer microfinance, provided the initiative is part of a greater integrated plan that includes an assessment of environmental and social risks
What can the private sector do?	Tour operators: • Engage in long term contracts with communities to stabilize income, while respecting the carrying capacity of the host communities and their environment; • Encourage tourists to contribute directly to the communities, rather than only financially through the operator; • Establish a fund for donations to the local community which can be used for addressing environmental stress that may occur from the increase in tourist arrivals; • Engage in promotional activities; • Aid government officials and community members to improve service while maintaining environmental quality. Other businesses: • Sell mainly local products; • 'Imported' products which are difficult to dispose of locally (e.g. batteries, medicine, etc.) can be taken back by tourists or operators on their way out of the HoB and properly disposed of in the city.
What can the Government do?	National: • Draft legislation that recognizes the human and legal rights of indigenous communities in the HoB, including land rights; • Set-up immigration points at key locations to enable transboundary ecotourism; • Promote (green) entrepreneurship, e.g. through budget allocations for SME development in forested areas; • Draft special guidelines for tourism development in forested areas; • Draft regulations to simplify tourist visits to concessioned forest areas (e.g. timber concession) and conservation areas (e.g. standard price on entry permit, guide from forest ranger, etc); • Negotiate lower airfares/ initially subsidize airfares for remote HoB areas, to stimulate ecotourism development; • Build capacity of government officials in charge of destinations such as national parks. Local: • Recognize and respect intellectual property rights and adat (customary law/rights) claims of local peoples; • Design fast track administration to settle land tenure issues favouring productive communities who manage their forests sustainably; • Invest in opening and improving small airstrips in the interior as main access to the HoB area, and improve basic infrastructure in village areas (bridges and roads, water and electricty supply, internet and telephone access); • Use budget/facilities of Ministry of Tourism for providing skill training for tourism development; • Facilitate fair partnerships between community organizations and 'willing' private sector; • In order to spread the gains from tourism equitably, and avoid conflict regarding the distribution of income, the local government can act as an intermediary: A fee or levy is charged on tourists for use of environmental services. The resulting income could be used to establish a PES scheme that can compensate members of the community who are not involved with the tourism business; • Require non-community based enterprises to get Free Prior Informed Consent (FPIC) from community concerned.
Contribution to...	• Securing natural capital: Ecotourism depends on aesthetic natural beauty. To be able to sell this product, natural ecosystems and biodiversity needs to be secured. With this, other essential ecosystem services are maintained benefiting downstream industries and society. • Poverty reduction: Well-planned ecotourism which involves local people in ecotourism activities can secure additional income. • Economic growth: Builds local economies and helps them diversify away from the energy and commodity sectors. • Climate change: This sector can reduce pressure to deforestation. By keeping the forests standing, ecotourism secures a natural buffer against climate change and supports climate mitigation.

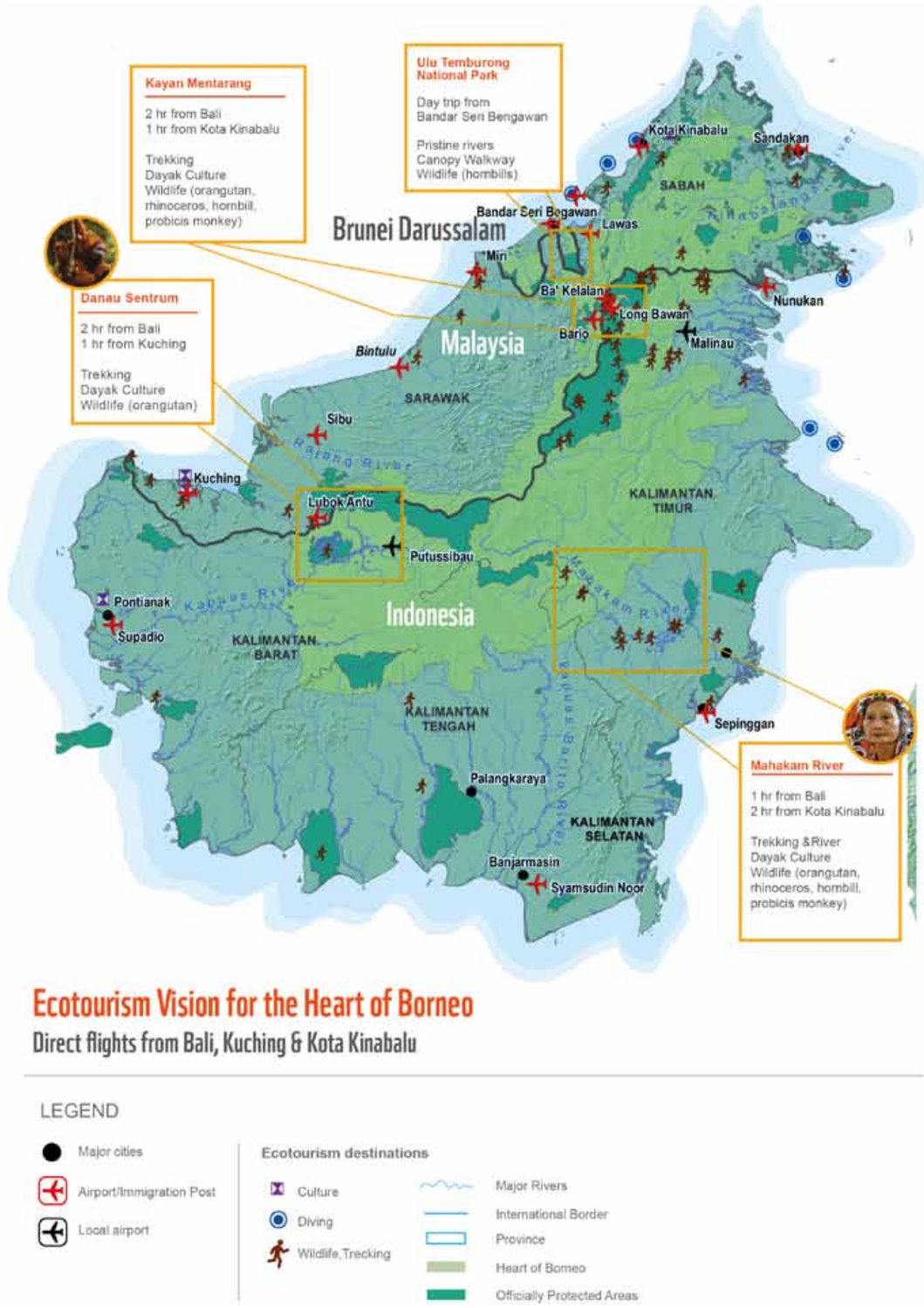

Figure 5.2: Vision for a transboundary HoB ecotourism destination

Box 5.1: What is needed to raise the HoB's tourism profile?

- Declare transboundary ecotourism in HoB as "ultimate" destination and experience and highlight the value of community-based ecotourism as appropriate scheme for the HoB area;
- Open official immigration posts (tourism) in Long Bawan (Kalimantan Timur) and Ba' Kelalan (Sarawak), and Lubok Antu (Sarawak and West Kalimantan);
- Develop an integrated (Brunei, Malaysia, Indonesia) promotional and marketing strategy for HoB Ecotourism;
- Optimization of air transportation for ecotourism: improvement of key airstrips in the interior; explore possibility of opening selected cross-border air routes in HoB (for example: Miri-Bario-Long Bawan-Nunukan; Miri-Lawas-Long Bawan-Nunukan; Kuching-Putissibau);
- Incentives to district governments to subsidize regular flights to the main ecotourism destination areas in the interior (Krayan, HuluBahau/ Pujungan, Putissibau, etc.;
- Support, adopt and promote local packages developed by local communities and organizations, together with tour operator;
- Put in place standards, community benefit-sharing, community-private partnerships, and capacity building.

Ecosystem restoration services	
What is the issue?	Degraded ecosystems cannot provide their many ecosystem services properly anymore, causing risks not only for those who live on the land concerned, but throughout the watershed. Many forests in the HoB are under threat of degradation.
Who is the seller?	Communities or companies, or a combination of the two, whereby a company sub-contracts implementation and monitoring to communities.
Who is the buyer?	Land owner, concession holder, government
Steps towards successful business model:	• Acquire technical knowledge for ecosystem restoration; • Build good relationships with local communities and involve them in planning process; • Implement plan.
What can banks do: What can the private sector do?	Engage in public-private partnership with government to engage in biobanking (See biobanking below) for conservation and ecosystem restoration. • Use and develop local community capacities in the industry; • Support the tagal system by working closely with the local communities; • Businesses can explore market and exploit the opportunity; • Businesses can approach local communities who manage their forest sustainably to jointly develop a restoration plan and subcontract their services in its implementation; • Communities can form a business that provides ecosystem restoration services professionally.
What can the Government do?	National: • Create a budget line for PES or ecosystem restoration and allocate budget; • Make restoration mandatory for certain economic activities; • Incentivize companies to restore degraded land by releasing restoration-concession holders from land tax while restoration is in progress; • Incentivize companies to apply for restoration concessions by granting them priority to participate in the REDD+ scheme, once the mechanism is in place. Local: • Create a market by purchasing restoration services; • Countries whose national development plans envision a knowledge-based economy, can use related allocations to fund advanced technical training and knowledge transfer for ecosystem restoration; • Exempt concession holders from yearly permits (self approval of activities); • Make restoration-concession eligible to obtain dedicated public funds.
Contribution to...	• Securing natural capital: Restores the ecological functions of ecosystems and biodiversity; more intact natural stocks (forest, soil, water, biodiversity) increase the flow of ecosystem services; investing in timely ecosystem restoration prevents severe degradation in the future. • Poverty reduction: Income can be earned, additionally or as a main profession, by community groups implementing and monitoring restoration plans; more intact natural stocks increase flow of potential revenue streams from ecosystem goods (forest products, fish, tourism) for local communities. • Economic growth: By creating a market for these services, income can be gained from them, adding to economic activity. • Climate change mitigation / adaptation: Restoring forest ecosystems will create a buffer against the impacts of climate change, as carbon sink function increases.

Protecting and restoring abandoned logging concessions	
What is the issue?	Inactive logging concessions represent land already committed to economic exploitation where, for various reasons, logging has been abandoned. Concessions that are inactive can be subject to illegal logging and encroachment due to access provided by roads that are constructed by companies to reach their concession. The loss of value from degradation may then result in these lands becoming idle and even being abandoned completely. Lack of proper management and restricting access by local communities who traditionally maintain the forest can result in degradation to the point where the forest cannot recover and the area becomes a wasteland.
Steps towards successful business model:	• Proactive spatial planning which identifies inactive concessions and addresses possible degradation; • Hold concession holders responsible for maintaining forest on concession lands; • Hold local governments responsible for minimizing inactive concessions, by providing incentives to reduce their number.
What can the Government do?	National: • Develop a regulatory framework under which concession rights are removed if concessions are inactive for more than a certain time span, provided that no proper forest management is arranged on the land in question; • Provide incentives for local governments to take responsibility for inactive concessions by providing competitive compensation for forest restoration/ management. Local: • Penalize companies who do not manage the forests on their inactive concessions in a sustainable manner; • Incentivize sustainable management of inactive concessions by concession holders, e.g. by extending exploitation permit.
Contribution to...	• Securing natural capital: Restores the ecological functions of ecosystems and biodiversity; more intact natural stocks (forest, soil, water, biodiversity) increase the flow of ecosystem services; investing in timely ecosystem restoration prevents severe degradation in the future. • Poverty reduction: Income can be earned, additionally or as a main profession, by community groups implementing and monitoring restoration plans; more intact natural stocks increase flow of potential revenue streams from ecosystem goods (forest products, fish, tourism) for local communities. • Economic growth: By creating a market for these services, income can be gained from them, adding to economic activity. • Climate change mitigation / adaptation: Restoring forest ecosystems will create a buffer against the impacts of climate change, as carbon sink function increases.

Biobanking	
What is the issue?	Significant finance is required to protect biodiversity and restore degraded ecosystems; a lack of financial incentive to conserve land makes it difficult to compete with other land uses that generate a financial return. Biobanking confers value to the land that allows it to compete with alternative land uses. The example of Malua BioBank has shown that there is a willingness to pay for biodiversity conservation services in the HoB (see box).
Who is the seller?	The owner of the land (private or government) or the company/government/ individual who has biodiversity rights over the area
Who is the buyer?	Private individuals /companies /organizations
Steps towards successful business model:	• Identify and characterize target market, i.e. a geographic area or industry in which there are market constraints on conservation that could be diverted to dedicated management areas; • Establish a long-term legal agreement to conserve the area and commercialize the rights to the environmental attributes; • Raise capital to invest in conservation works; • Estimate costs of land conservation and calculate/position the price of the product; • Establish conservation management plan and conduct protection or enhancement activities; • Quantify environmental attributes and, if applicable, submit for third-party approval certification; • Market environmental credits according to sales strategy; • Establish a perpetual charitable trust from funds generated from sales to fund ongoing management of the area or to endow long-term conservation management organization.
What can banks do:	• Generate and sell credits representing the rights to the conservation or enhancement of environmental attributes
What can the private sector do?	• Buy credits to improve environmental footprint of direct operations and across supply chains; • Buy credits to offset quantified reliably and independently verified environmental impacts; • Invest in biobanks.
What can the Government do?	• Businesses can explore market and exploit the opportunity; • Businesses can approach local communities who manage their forest sustainably to jointly develop a restoration plan and subcontract their services in its implementation; • Communities can form a business that provides ecosystem restoration services professionally. National: Integrate biobanking into national conservation strategy. Establish a market-based system for biodiversity offsets based on a legal requirement to compensate for environmental impacts from development. Local: Enable non-traditional organizations, such as financial institutions, to hold and manage 'conservation concessions'
Contribution to...	• Securing natural capital: Highly replicable and scalable model designed to raise capital to protect and restore the most valuable and threatened natural capital over the long term. • Poverty reduction: Biobanks are a potential source of financing for community forest management whereby biobank managers enter into a joint venture with impoverished and/ or disadvantaged landowners ensuring that revenues are shared and/or landowners are paid to protect and manage their land for its environmental attributes. The funding channeled towards conservation provides income and livelihoods for members of the community doing restoration work, patrolling, management, etc. • Economic growth: Biobanks work by assigning a commercial value to the restoration or protection of environmental attributes and attracting private capital to fund these outcomes. A new biobanking industry would add to GDP while ensuring that conservation of environmental attributes becomes fully integrated into sustainable development. • Climate change mitigation / adaptation: Carbon stocks are just one of a range of environmental attributes that biobanks could protect and enhance, thereby contributing directly to climate change mitigation. Bio banks focusing on biodiversity protection will also assist with climate change adaptation.

Box 5.2: Mitigation banking and biodiversity offset payments, Sabah, Malaysia.

The Sabah State Government licensed conservation rights for a period of 50 years to the Malua BioBank and a private investor has committed up to US$10 million for the rehabilitation of the Malua Forest Reserve over the next six years. In this initiative, the Malua BioBank sells Biodiversity Conservation Certificates (BCCs), for US$10, each representing 100 m² of rainforest restoration and protection.

Revenues from BCCs are used to recover costs incurred and to endow a trust fund ('Malua Trust') set up to manage the long-term conservation management of the Malua Forest Reserve over the remaining 44-year period of the license. Assuming all BCCs will be sold for the 34,000 ha area, the project has the potential to earn US$34 million.

At this point, there is no formal legal mechanism to allow third-party mitigation as a mitigation option for requirements in Sabah. The demand is driven by voluntary interest; however, there are ongoing efforts for Sabah to implement a 'No-Net-Loss Legislation'[7].

Bioprospecting	
What is the issue?	Due to its diversity, the HoB provides good bioprospecting opportunities. Genetic resources and agro-biodiversity in large parts of the HoB have been used, cultivated, managed and modified by local people for centuries. This rich tradition (codified in language, plant names, local pharmacopeia and recipes, etc) has made it possible to identify and recognize potential uses of plants and other organisms for food, medicinal and other purposes. The holders and custodians of this traditional knowledge should be enabled to share in the financial gains made from these genetic recourses. Rather than seeing bioprospecting solely as an opportunity for financial gain, the source country may want to negotiate a form of cooperation which builds institutional and human resource capacity for research and development.
Who is the seller?	Currently governments of countries engage in bioprospecting agreements as 'sellers'
Who is the buyer?	Pharmaceutical companies engage in bioprospecting agreements as 'buyers'
Steps towards successful business model:	• Establish database of species found in the HoB and related traditional knowledge; • Establish procedure to secure intellectual property (IP) rights; • Establish a mechanism for benefit sharing with local communities; • Raise community awareness concerning their IP rights; • Provide a one-stop shop for prospective bioprospecting customers. • Generate and sell credits representing the rights to the conservation or enhancement of environmental attributes
What can investors do	Exploit investment opportunities
What can the private sector do?	• Start joint ventures with local communities, to enable local retention of financial gains and knowledge and capacity building.
What can the Government do?	National: • Develop action plan for implementing Nagoya protocol for equitable benefit sharing under CBD; • Resolve issues regarding the rights of indigenous communities in the HoB, including Intellectual Property rights; • Devolve authority to enter into bioprospecting agreements to province/district governments, to facilitate local benefit sharing; • Countries whose national development plans envision a knowledge-based economy can use related budgetary allocations to fund advanced technical training and knowledge transfer in biochemical sciences. Local: • Establish biodiversity center as knowledge hub, one-stopshop for bioprospecting "customers", provide related space, equipment and laboratory services for sample analysis.
Contribution to...	• Securing natural capital: By attaching value to biodiversity in this way, natural capital will gain appreciation in general. However, the challenge lies in ensuring the ability to share the benefits of biodiversity with the local communities who are the custodians of the resources. • Poverty reduction: Poverty reduction can be attained through bioprospecting provided benefits are shared with the local communities. • Economic growth: Both the pharmaceutical industry and the conservation-related industries are boosted through bioprospecting; if benefits are shared equitably this will further boost the local economy. • Climate change mitigation / adaptation: As bioprospecting requires biodiversity, it duly requires healthy ecosystems, which in the HoB inevitably entails health forest ecosystems. Thus, lucrative bioprospecting serves as an incentive to forest conservation and avoidance of deforestation and forest degradation and related carbon emissions.

Greening high impact sectors

Large-scale, high-impact sectors, including logging, palm oil cultivation and mining, play an important role in the current economies of Borneo. They require a range of investments from both public and private channels to enhance their sustainability. Positive incentives put in place by governments to stimulate business to follow certification processes, internationally recognized sustainability standards and penalties to discourage unsustainable practices, will all help to change behaviour. The most relevant ones to the HoB are elaborated in more detail:

- **Certification for responsible timber supply**, which would include improved forestry practices such as reduced impact logging, maintaining High Conservation Value Forests (HCVF) and forest restoration;
- **Certification for responsible palm oil cultivation**, which would prohibit expansion into natural forests, encourage expansion only on already degraded land and include improved fertilizer and pesticide application methods;
- **Responsible development of sustainable hydropower** following international good practice guidelines, and;
- **Responsible mining,** also following international good practice guidelines, with improved waste management treatment reducing impacts on air and water quality.

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Certification for responsible timber supply	
Description	Certification is a way to indicate to buyers that the producer has upheld certain standards of conduct embodied in the certification requirements. For responsible timber production, this entails responsible forest management, taking into account the forest's role in regulating water flow, preventing floods and landslides, storing carbon and providing habitat. It also involves avoiding logging or plantation development on High Conservation Value Forest (HCVF), which is a classification established by the Forest Stewardship Council (FSC). Social aspects are also addressed.
What is the issue?	Forests play an essential role in regulating water flow, preventing floods and landslides, maintaining soil functions, storing carbon and providing habitat for endangered and other species. Depletion and degradation of forests affects their ability to perform these functions. Furthermore, in some countries, concession systems restrict local communities' access to forests which have traditionally helped to provide their livelihoods.
Who is the seller?	Companies
Who is the buyer?	Middlemen, companies
Steps towards successful business model:	• Where necessary, adapt requirements of existing certification bodies to local policy, legal and institutional conditions; • Promote and incentivize certification.
What can investors do	Investors and lenders can deny uncertified companies credit and adopt certification as a criterion for eligibility to credit
What can consumers do?	• Invest in meeting the certification standards and in getting certified; • Lobby for extending the duration of exploitation permits, so that businesses will have an incentive to adopt a longer-term view; • Negotiate with local communities on a compromise to solve restricted access and exploitation rights. • Buy certified wood/paper/pulp products.
What can the Government do?	National: • Extend the duration of concessions and exploitation permits, so that producers have an incentive to adopt a longer-term perspective on forest management. Local: • Tax uncertified businesses and waive taxes for certified businesses; • Only issue long-term exploitation permits.
Contribution to...	• Securing natural capital: Contributes to the health of ecosystems and ecosystem services. • Poverty reduction: Solving problems of restricted access, local communities can revert to traditional forest-based activities for extra income. • Economic growth: By solving problems of restricted access, traditional local economies can be revived. Natural capital (including ecosystem goods and services) is maintained, benefiting a range of economic sectors in the region and avoiding unnecessary environmental costs. • Climate change mitigation/adaptation: Restoring forests improves their capacity as carbon sinks, which supports the mitigation of climate change.

Certification for responsible palm oil cultivation	
Description	For responsible palm oil cultivation, certification entails responsible management of land, including taking habitat loss, carbon emissions, fire and watershed and land degradation into account within management and contingency planning. Social aspects are also addressed.
What is the issue?	Conversion of forest to palm oil plantation is occurring at a rapid pace in Borneo. As forest cover is eliminated, forest ecosystem services such as water regulation, flood and landslide prevention, soil function maintenance and habitat provision services are eliminated. Especially on peatlands, conversion triggers near irreversible damage. Quality and quantity of water supply are affected, with resulting impacts on aquatic life and human health. Current land use legislation does not take traditional claims to ancestral lands into account, often causing social conflict and vulnerability to poverty. Degraded land is available but currently not favored for palm oil cultivation due to extra costs (bureaucracy, land conflicts, delays).
Who is the seller?	Companies
Who is the buyer?	Middlemen, companies
Steps towards successful business model:	• Contact an accredited certification body for initial information on certification principles and criteria, costs and time; • If needed, implement changes in areas in which you are not yet compliant; • Assessment is conducted by an approved certification body on the basis of which certificate of compliance is issued, or rejected with recommendations on further required action to obtain certification.
What can investors do	Investors can deny uncertified companies credit and adopt certification as an eligibility criterion for lending.
What can the private sector do?	• Invest in certification; • Lobby for extending the duration of exploitation permits, so that businesses will have an incentive to adopt a longer-term view; • Assist smallholders with information and technology to meet certification standards.
What can consumers do?	• Buy from producers who are committed to 'green procurement' and use certified palm oil in their production chain
What can the Government do?	National: • Provide financial incentives in the form of subsidies for use of degraded land; • Prohibit, or place steep fees on, conversion of forested land; • Where necessary, adapt requirements of existing certification bodies to local policy, legal and institutional conditions; • Promote and incentivize certification; • Reduce barriers to certification for smallholders; • Draft legislation that recognizes the rights of indigenous communities in the HoB, including tenure/use rights; • Extend the duration of concessions and exploitation permits, so that producers have an incentive to adopt a longer-term view on land and water management. Local: • Prioritize use of existing degraded land for future expansion of palm oil; • Develop degraded land database showing location, soil type, owner and current land use; • Preferential taxation for certified businesses; • Only issue long-term exploitation permits.
Contribution to...	• Securing natural capital: Contributes to the health of ecosystems and ecosystem services. • Poverty reduction: Lack of adequate quality water sources has great impacts on the lives of the poor; addressing degradation reduces vulnerability to shocks. • Economic growth: Palm oil industry can continue to provide income in a way that ensures a sustainable supply in the future. • Climate change mitigation / adaptation: Despite the detrimental effect of monoculture on resilience to climate change, palm trees do fix carbon.

Box 5.3: Land status swaps for palm oil concessions on forested land[8]

A land status swap is a mechanism to divert oil palm expansion (or other activity such as plantation forest) from forest areas by swapping a concession on forest land with one in an area with no forest. New oil palm plantations often overlap with forest areas. Conversion of forests to plantations leads to high biodiversity losses, GHG emissions and decline of ecosystem services. Land swaps can mitigate the loss of valuable ecosystem services and contribute to retaining natural capital. Furthermore, by preventing the destruction of forests and drainage of peat, large carbon sinks are secured. Using degraded land for oil palm expansion will not only prevent emissions, it could even result in a net sequestration of carbon[9].

Implementing this strategy, however, is complex due to challenges in both mapping capacity and policy barriers. Often the provincial land database only includes existing usage and land tenure, but does not include degraded land, does not specify soils, forest cover or other dimensions of economic potential. Degraded land is often left out of the spatial planning process altogether. Despite these obstacles, some encouraging pilots are in progress concerning land status swaps to divert oil palm plantations to degraded lands.

Current regulations fail to provide easy access to degraded land for oil palm cultivation; lack of a degraded land database, no access to degraded land and land conflicts between concessions and communities all contribute to the challenges of using degraded lands. Disparity and the scattering of available degraded lands represent additional complications.

Spatial planning reform, inspired by the pilots currently evolving, would prioritize degraded land over forested areas for palm oil plantation location permits and refrain from entering into concessions on forest areas. It would subsidize the use of degraded land and/or allocate high carbon taxes on forested land. The latter might also be necessary to encourage the private sector to use degraded areas.

Oil palm concessionaires may have to be compensated or otherwise incentivized to shift from forested land to degraded land, e.g. through a compensation fund or by providing access to cheap credit for businesses willing to swap existing concessions in forest and peat areas. For companies, identifying suitable degraded land for oil palm development before the development is planned reduces the costs of environmental impact mitigation, or in the case of sustainable oil palm development, the cost of implementing additional due diligence activities[10].

Responsible development of sustainable hydropower	
Description	Responsible development of hydropower fulfills sustainable development principles and is socially, environmentally and economically responsible, transparent and accountable.
What is the issue?	The development of hydropower dams creates significant environmental and social impacts and loss of natural resources. It places increased pressure on already reduced forest cover and freshwater resources. These impacts can be avoided or reduced and hydropower development can be made more sustainable with proper development planning, assessments, mitigation measures and conservation efforts. If developed responsibly and sustainably, hydropower can provide great economic and social benefits with manageable environmental impacts.
Who is the seller?	Developers of hydropower
Who is the buyer?	Governments, businesses and domestic consumers
Steps towards successful business model:	• Comprehensive and transparent energy needs assessments, energy production options assessments and environmental and social impact analysis; • Areas with critical natural assets and areas of high conservation value are protected; • A representative sample of free-flowing rivers and their ecosystem services is maintained; • Credible information is made publicly available to present the best options, locations, designs and operating rules; • Develop multi-stakeholder planning process (state and local government, local communities, operators, businesses, NGOs); • Follow internationally accepted best practices, standards and principles; • Create financing mechanisms (e.g. REDD+) which encourage conservation of the natural assets (e.g. forests) by the local community on lands provided to them in resettlement schemes or those living within watershed areas; • Establish programs to encourage environmental and socio-cultural protection, e.g. river heritage programs; • Systems to distribute economic returns fairly among stakeholders.
What can investors do	Adopt and enforce responsible financing mechanisms based on sustainable development criteria
What can the private sector do?	Energy Suppliers • Ensure energy resources are developed responsibly and sustainably; • Invest in conservation and enrichment efforts in affected river basins; • Establish hydropower planning and development processes to help minimize social, cultural and environmental impacts; • Participatory development of watershed management plans.
What can consumers do?	Energy Purchasers • Adopt and implement responsible business activities, which include sourcing and purchase of energy from sustainably managed sources; • Apply technology and management practices to prevent or mitigate pollution; • Adopt hiring policies that promote local community inclusion and capacity building; • Contribute to conservation of natural resources and ecosystem services which are shared both by the communities and the businesses, e.g. the protection of watersheds for water resource conservation.
What can the Government do?	National: • Comprehensive energy planning and development to identify needs and best options with respect to economic, environmental and social considerations; • Create incentives and enabling environments for businesses that undertake conservation and proper management of natural resource, e.g. green energy certification systems; • Require legal mechanisms and national project approval mechanisms which include cumulative impact assessments of development policies and plans; • Create financing mechanisms whereby a percentage of payments from large consumers of water, developers and downstream industrial users are put towards improving water quality and habitat restoration in the watershed. Local: • Strict enforcement of environmental and social impact assessments prior to project development; • Create a framework or structure for multi-stakeholder and integrated water resources and land-use planning and management; • Design and establish sustainable income opportunities for communities (e.g. ecotourism areas and eco-villages).

Contribution to...	• Securing natural capital: A share of revenues can be directed towards conservation of high conservation value and heritage areas. Hydropower is a viable renewable energy resource that can replace other more harmful energy production options. Multi-purpose reservoir use is possible to prevent loss of natural assets due to flood damage. Hydropower can be used in combination with other sources of renewable energy that provide intermittent supply (e.g. solar, wind power). • Poverty alleviation: Creates jobs, infrastructure and capacity; generates alternative revenues, and support for local community services (e.g. schools, hospitals and roads). • Economic growth: Responsible hydropower development can generate job opportunities, help build a qualified workforce, and mitigate losses from floods, secure natural resources such as water and energy. • Climate change mitigation/adaptation: Hydropower can reduce: 1) The reliance on fossil fuels for energy production; 2) Carbon footprint of an economy; 3) The vulnerability of communities and economies to climate change induced water extremes (e.g. floods & droughts).


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Responsible mining	
Description	Mining will always impact the environment. There are, however, ways in which mining impacts can be minimized and methods which allow for recovery up to a certain degree. This can be done by smart mine design that incorporates potential post-mining use and mitigation measures during operations.
What is the issue?	Most prevalent in the HoB is open pit coal mining (due to the relatively shallow location of the deposits), while gold is mined mostly from the rivers. Since non-alluvial deposits are often found together with copper, renewed interest is emerging in open-cast mining. Habitat loss, watershed and soil degradation, erosion, land subsidence, dust, social issues, degradation of water quality , hazardous waste are common problems related to mining. Coal is transported over long distances, adding to CO_2 emissions and fragmenting habitats. In addition, transshipment facilities are inefficient, resulting in more environmental damage. Gold is sometimes mined illegally in the HoB with the use of mercury, severely endangering human and aquatic life.
Who is the seller?	Mining companies/ illegal miners
Who is the buyer?	Mostly electricity suppliers (coal power plants) or other industries requiring coal for energy in their production processes, such as cement plants, asphalt factories or chemical plants.
Steps towards successful business model:	• Improve the quality of environmental impact assessments (EIA) and ensure they meet international standards; • Build capacity of local government to participate in the EIA process; • Enforce the implementation of environmental monitoring and management plans; • Require industries that use coal to show certificates of origin to impede illegal mining. • Invest in new technologies that allow power generation from low-carbon coal to increase efficiency of coal use; • Invest in research on renewable energy to make it competitive with coal; • Invest in underground mining.
What can Banks/investors do?	• Uphold guidelines such as those prepared by the World Bank[11] and require any mining initiative funded to adhere to them; • Development banks such as the World Bank can aid local capacity building to properly monitor mining operations.
What can the private sector do?	• Use the EIA as intended, carefully mitigating as much as possible impacts on water use and quality, wastes, hazardous materials (in case of gold mining), land use and biodiversity, air quality, noise and vibrations, energy use and visual impacts; • Require buyers of gold, and industries and electricity suppliers who use coal, to show certificates of origin to impede illegal mining; • Invest in more efficient transportation systems; • Invest in underground mining; • Invest in corporate social responsibility (CSR).
What can the Government do?	National: • Strengthen enforcement of current regulations (incl. EIA); • Expand capacity to monitor compliance with regulations. Local: • Strengthen enforcement of current regulations (incl. EIA); • Expand capacity to monitor compliance with regulations; • Ensure that all mining concessions complete a mine closure plan.
Contribution to ...	Securing natural capital: Preventing the worst forms of degradation. Poverty alleviation: Creates jobs, infrastructure and capacity if tied into local economies. Economic growth: Can generate job opportunities, qualified workforce and capacity if tied into local economies.

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Innovative green sectors

A third category of green economy solutions consists of so-called innovative green sectors. The sectors showcased here are able to substitute for fossil fuels and, in one case, can utilize waste flows. The sectors are:

- Biogas, which is a mixture of methane and carbon dioxide, can serve as a high-energy renewable fuel. Both liquid and solid wastes, e.g., palm oil mills effluent (POME), may be used to produce biogas. This sector helps to solve a waste disposal problem while mitigating CO_2 emissions, and;
- Micro-hydro power, defined here as water-sourced electric power with capacity of less than 100 kw which is produced by generators placed in streams, is a clean energy source that consumes no natural resources, produces no emissions and generates no waste. It may be particularly appropriate for communities that are not currently connected to the national grid.

Energy and biogas	
Description	Industries generally look at waste as burdens for which they need to find solutions. However, with the right technologies, waste can be utilized as raw material for generating energy. Both liquid waste (e.g. dung, liquid manure and other bio-waste such as Palm Oil Mills Effluent (POME)) and solid wastes can be processed into gaseous fuels, which can in turn be used for energy generation, while avoiding the GHG emissions related to the use of fossil fuels. Biogas–a mixture of methane and carbon dioxide–is created during anaerobic fermentation of liquid wastes and serves as a high-energy, renewable fuel that can be used as a substitute for fossil fuels. High-quality fertilizer is a by-product of this process. Syngas is produced through gasification of solid wastes and can be likewise be used for rural electrification. Typically, one to two kg of solid waste can produce one kWh of electricity.
What is the issue?	The domestic energy demand of the HoB countries has been largely met through fossil fuels in the last few decades, notably oil, coal and, more recently, natural gas. Energy use is the second largest source of GHG emissions, following emissions from land use changes, including deforestation and peat fires. It is also one of the fastest growing sectors. In the HoB, many communities are not connected to the national grid, instead getting their electricity from generators which run on fossil fuels. The fuel has to be bought and transported from the cities. Furthermore, waste from palm oil mills and plantations is abundantly available in the HoB and can be part of a comprehensive solution to a complex waste problem, combining regulatory implementation, industrial burden, energy conservation, community income, standard of living, regional economy and environmental protection.
Who is the seller?	Many combinations can be envisioned depending on the business model.
Who is the buyer?	Many combinations can be envisioned depending on the business model.
Steps towards successful business model:	• Stricter law enforcement on waste handling policy; • Incentivize companies to partner with specialized waste handling companies to handle waste in accordance with regulation; • Technology provider offers comprehensive solutions; • Developer/investor commences commercial piloting and conducts capacity building; • Community seizes opportunity of conducting business as small power producer cooperative, or as waste/raw material logistics cooperative.
What can Banks/investors do?	Financial institutions can channel 'green and clean' energy funding into appropriate technology initiatives.
What can the private sector do?	• Abide by waste handling regulations; • Piloting and building capacity in local communities; • Establish corporate social responsibility (CSR) program to channel result of waste processing initiative for the benefit of community.
What can the Government do?	• Stricter enforcement of regulations; • Awareness raising about available renewable energy incentives.
Contribution to ...	• Securing natural capital: Finding solutions to waste problems in the HoB (including effluent from palm oil plantations and mining) contributes directly to improvement of natural capital. • Poverty reduction: The poor can benefit from these green solutions through rural electrification and income-generating opportunities; their quality of life is also enhanced through better environmental quality. • Economic growth: Both industries and local communities enjoy new economic opportunities. • Climate change: Providing green alternatives to energy generation directly mitigates emissions.

Micro-hydro power	
Description	Micro-hydro power is water-sourced electric power with capacity of less than 100kw from generators that are placed in a small stream. The power of the stream is harnessed by installing a water wheel that, when turned, feeds a power generator. Micro-hydro power generation is a clean, sustainable energy source that consumes no natural resources, produces no emissions and creates zero waste. It can provide electricity on a modest scale.
What is the issue?	Many communities in the HoB are currently not connected to the national grid and get their electricity from generators which run on fossil fuels. The fuel has to be bought and transported from the cities. Their access to energy could be improved through micro-hydro initiatives. Due to its modest scale, the problems encountered with big dams, such as loss of biological diversity and habitats, disruption of migration routes, and a host of social problems such as involuntary relocation and loss of livelihoods are avoided. Big dams, however, can provide energy beyond the local needs and provides industries with 'GHG-free' energy. Micro-hydro initiatives therefore cannot substitute for big dams to meet industrial demand, but can be useful in supplying electricity to entire villages.
Who is the seller?	To date there is no trade in electricity generated from the micro-hydro stations in the HoB. Based on village meetings, electricity is distributed to each household and public facilities (e.g. hospital, government's offices, etc.). Each household is requested to make a modest financial contribution for cable network maintenance, engine maintenance, etc.
Who is the buyer?	Thus far, there has been no trade in electricity, but there are some potential buyers (i.e. local businesses, government, etc.).
Steps towards successful business model:	• Undertake feasibility study; • Community organizes itself for management and maintenance of the micro-hydro power generator (MHPG) and protects the intake forest for sustainability of the water supply; • Develop standard operating procedures; • Develop business model including tariff of electricity supplied and price for household and business buyers; • Develop local regulation for MHPG maintenance and related management issues, including conservation regulation for protecting water catchment area; • Maximize the utilization of installed capacity by developing or stimulating small-scale business within community.
What can Banks/investors do?	Channel green and clean energy funding into appropriate green energy initiatives.
What can the private sector do?	• Support micro-hydro initiatives with technical skill and managerial knowledge; • Use MPHG as part of CSR program; • Implement environmentally-friendly practices to maintain catchment area.
What can the Government do?	National: • Raise awareness about the current renewable energy incentives available under national policies. Local: • Facilitate connections between communities and institutions mandated to work on rural electrification and green energy promotion.
Contribution to...	• Securing natural capital: Forests surrounding the stream are properly managed to secure water for the power station, reducing the threat of deforestation. Trees are no longer cut down to meet the village's fuel needs. • Poverty reduction: With no need to buy diesel to power their generators, the cost of living has decreased. This money can now be spent on health and education measures, etc. Reliable electricity supply for lighting needs, cooking utensils and other appliances improves day-to-day standard of living. • Economic growth: Electricity, e.g. through lighting and the use of appliances, can free up time to engage in income-generating activities. • Climate change mitigation/adaptation: Though the conservation of forest, but most importantly through substituting conventional energy sources with a green alternative, GHG emissions are mitigated.

Cross-cutting solutions

This section presents interventions which take place across a landscape. They include: participatory ecosystem-based spatial planning, integrated watershed management and expanded and strengthened protected area networks. These interventions respond to challenges that cannot be solved through sector-specific approaches. The cross-cutting solutions discussed below are capable of providing substantial benefits to natural capital and thereby providing important contributions to the economy and to society.

Participatory ecosystem-based spatial planning

Current spatial planning processes in national and sub-national contexts face a number of issues which complicate and often undermine their efforts: institutional changes, decentralization, cross-border and transnational planning, vertical and horizontal integration, mainstreaming of bottom-up approaches and involvement of multiple actors on different levels with different interests and intentions. These processes also rarely take the full value of ecosystems and biodiversity into account. Lack of stakeholder involvement is one reason for this outcome. Land tenure conflicts, particularly where traditional community rights remain unclear vis-à-vis the conventional legal system, further complicate matters. Finally, sectoral planning is not done in a holistic manner and no consideration is given to climate change mitigation and adaptation.

Participatory ecosystem-based spatial planning is a tool for landscape management that uses ecosystem boundaries as the delineating factor, rather than district, state or other administrative boundaries. It targets the harmonious co-existence of all living organisms (human being, plant, animal, and microorganism) and the abiotic environment[12] —aiming to guide, arrange and balance a wide range of activities associated with resource use. It represents a holistic approach to spatial planning for human activity and balances this with the needs of ecosystems. As such, it gives fair consideration to development needs while also securing natural capital.

Coherent ecosystem-based spatial planning also provides greater predictability for investment decision making. By avoiding development in flood prone areas, for example, investment risks can be minimized. Hence, it is an excellent tool for development planning and for ensuring sustainable economic growth. A spatial planning approach can also enable more efficient land-use. It can be used to support the efficient use of degraded land by allocating new forest plantations, e.g. for pulp and paper or wood for commercial construction, on deforested or degraded lands. This may be combined with measures to protect remaining HCVF in areas that are being developed. In this manner, the most ecologically valuable land is conserved, e.g. through the creation of new protected areas, and less ecologically valuable lands become economically productive. Finally, the approach may be critical for climate change mitigation and adaptation by guiding development to avoid high-carbon stock areas and sustain ecosystems vulnerable to climate change.

An effective process of participatory ecosystem-based spatial planning requires appropriate legislation, which needs to be adhered to, along with appropriately trained personnel to implement and monitor the process. Finally, the process must be adequately funded. For example, in some cases the legal mandate may need improved procedures for stakeholder participation. By mapping information about ecological and environmental conditions, and conducting analyses which rightly recognize the values of ecosystems and biodiversity, effective plans can be negotiated. Ideally, degraded or abandoned lands should be included in the analysis, for they may have important trade-off value. Responsible institutions may require enhanced capacity to implement and enforce spatial plans. Monitoring and evaluating performance and adapting plans as needed are additional, integral elements of a coherent, ecosystem-based spatial planning cycle.

The conservation of ecosystems and biodiversity through protected areas plays a significant role in a green economy.

Box 5.4: Indonesia's Heart of Borneo as a Strategic National Area

The HoB landscape in Indonesia, covers an area of 16 million ha of Kalimantan, has been designated as a Strategic National Area (KSN) under PP 26 (2008) for its natural capital value. The Heart of Borneo Working Groups at national, provincial and local levels has been actively engaged in an ecosystem-based spatial planning process (between 2008 and 2011). The Indonesian HoB National Working Group is currently working with agencies across sectors to integrate ecosystem and biodiversity values into government land use plans and policies. The ecosystem-based spatial planning process considers HoB's value for livelihoods of local impoverished communities, as a source of water for the majority of people in Kalimantan, to support global climate change mitigation efforts and as a global biodiversity hotspot. A presidential decree for this HoB specific spatial plan (scale 1:50,000) is in the process of approval.

Integrated watershed management

Integrated watershed management aims to promote the coordinated development and management of water, land and other resources in a watershed in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems and the environment[13]. Since watersheds and river basins are also ecosystems, watershed management makes use of ecosystem-based spatial planning (see preceding sub-section) as a tool.

Integrated watershed management is critical to sustaining economic welfare in the long term.

Responsibility for management of river basins, watersheds, freshwater sources, water quality, and land-related resources is typically spread across several different ministries and districts, all of which have different management systems. This diffusion of authority greatly hinders effective management. In some cases, institutions may have overlapping mandates. As institutional issues are too complex to tackle within the scope of this study, the solution brought forward aims at harmonization among different entities, starting with the harmonization of indicators. This can form the basis for information exchange and eventually harmonization of management and joint planning.

If governments want to reform current water resource management structures, they may consider/explore the implications of establishing a Ministry of Watersheds (e.g. as in China), which is on equal footing with other Ministries, in order to enable spatial planning on a watershed basis.

An active coordinating body can provide a forum for multiple stakeholders dealing with a specific watershed. This body can facilitate, or broker, negotiations regarding division of responsibilities and development rights within a watershed. A process of this kind can help to safeguard water resources for the population at large but also for the use of industry and other economic sectors.

Expanding protected area networks and improving connectivity

Protected areas (PAs) are areas that receive official protection because of their recognized natural, ecological and/or cultural value and are essential for biodiversity conservation and the provision of ecosystem services. They are areas set aside for their vital role in maintaining the functions of natural ecosystems that humans depend on, to act as refuges for species and/or to maintain ecological processes that cannot persist within more actively utilized areas. Increasing the size of protecting areas and enhancing their connectivity helps to preserve their ecological integrity while facilitating gene flow and promoting ecosystem resilience against the impacts of climate change. These are all important elements in a green economy.

Current PA systems in Borneo suffer from numerous problems, including insufficient funding and lack of capacity for sustainable management. Current PA size and distribution (see Table 5.1 below) does not protect a sufficiently representative set of habitat types or viable populations of threatened and endemic species over the long term, and spatial plans do not incorporate connecting corridors allowing for migration. This is becoming increasingly important as climate change starts to affect the

range and distribution of species. Participatory ecosystem-based spatial planning can help stakeholders define which areas are most important for protection and for connectivity. It can also ensure that stakeholders whose livelihoods depend on the forest or on related ecosystems are involved in the planning process and decision making regarding these lands.

Urgent attention is required to improve the situation, including building capacity and ensuring financial sustainability of PA systems. Key steps include exploring ways to increase and retain revenues—through mechanisms such as ecotourism levies, payment for ecosystem services, and environmental exit taxes on visitors—while reducing costs through improved efficiency and specifically through innovative partnerships with indigenous communities, private landowners, tourism companies, etc.[15].

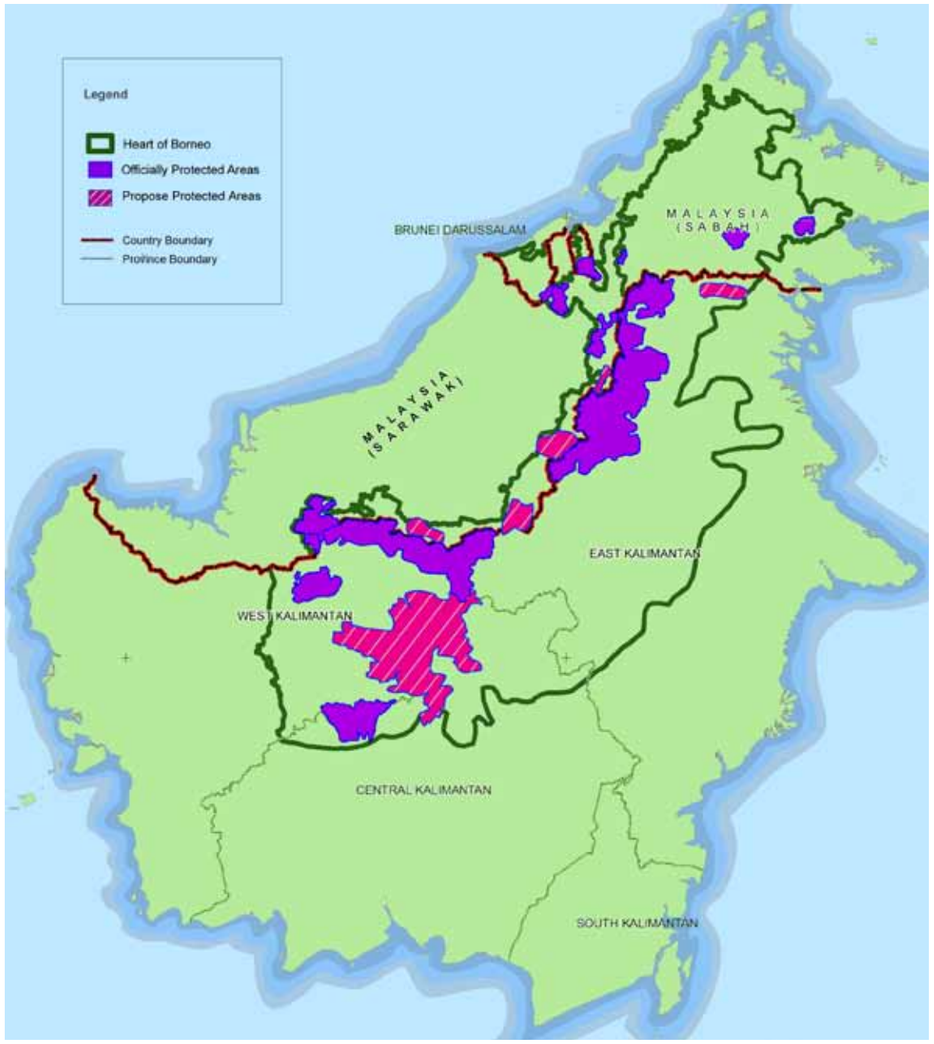

Figure 5.3: Protected areas and proposed connectivity corridors

Table 5.1: Protected area coverage, by ecosystem type[14]

Ecosystem	Area protected	% of remaining ecosystem
Lowland rainforest	3355 km²	9.6 %
Upland rainforest	13177 km²	18 %
Montane forest	9959 km²	29 %
Heath forest	<300 km²	<1 %
Limestone forest	<200 km²	<1 %
Peat swamp forest	<100 km²	<1 %

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5.2 THE ROLE OF OTHER STAKEHOLDERS

What's in this chapter

- Potential roles of key stakeholder groups, including business, civil society, the global community and media

Role of business and HoB's Green Business Network

Opportunities to expand biodiversity-based industries, including new green sectors and more innovative schemes such as biobanking and bioprospecting, imply that there is likely to be continued interest in forests to help diversify economies in the three countries.

Businesses operating within the HoB can support this process by:

- **Ensuring that their impacts on natural capital are either minimized or positive**: This should apply throughout production, as well as in procurement and outsourcing activities.
- **Sharing information through platforms such as forums, roundtables or through certifying organizations such as the Roundtable on Sustainable Palm Oil (RSPO)**: This can greatly reduce the costs of risk assessment and data collection. Partnerships with like-minded businesses, organizations or NGOs can help to fill gaps in knowledge related to green business operations.
- **Ensuring transparency and accountability**: This is important both for trust within partnerships as well as to provide the basis of trust in community relations.

Other businesses such as financial institutions, together with their shareholders, can play an important role through public-private partnerships and by devising innovative ways to finance and capitalise on conservation (see Chapter 4.2 on economic instruments).

The first task of businesses operating in the HoB is to ensure that their impact on the natural capital they and/or other sectors depend upon is minimized or positive.

Box 5.5: The Heart of Borneo Green Business Network[16]

In 2011, the HoB Green Business Network (HoB GBN) was launched in Indonesia and in Malaysia as a business community network committed to playing a leading role in the transition towards a green economy. The HoB GBN brings together stakeholders to generate tools and provide support to businesses willing to work towards a sustainable future for the HoB. It provides a forum for connecting relevant parties, allowing them to work together to exchange experiences on sustainable production and consumption, discuss new opportunities, discover matchmaking opportunities, etc. The network strengthens green business along the supply chain, contributes to the body of knowledge regarding production and business in the HoB and helps improve access to knowledge, tools, and empirically proven solutions.

Role of global community

International organizations, agreements and commitments, such as the Millennium Development Goals (MDGs), the United Nations Conference for Sustainable Development (UNCSD) and the United Nations Climate Change Conference (UNFCCC), set the agenda and provide the backdrop against which the concept of the green economy has emerged. This does not mean that a new idea has emerged, merely a more consolidated approach towards sustainable development, whereby the value of nature in economic activity is accounted for.

The global community has a particularly important role to play in strengthening forest-related governance, creating transparent mechanisms for addressing the drivers of poor forest management and mobilizing financial resources to protect forests and to reduce the economic pressures for forest conversion. Briefly, the international community can help in the following ways:

Direct REDD+ finance in the framework of a green economy: Carbon sequestration by forest ecosystems is one of the many globally significant values negatively impacted by deforestation and forest degradation. The global community needs to support the development of economies that recognize the true value of forests, not only to support climate mitigation and biodiversity conservation but also for the range of resources, ecosystem goods and services that forests provide. Placing REDD+ within the framework of a green economy is essential in order to ensure its success.

Support biodiversity-based industries, greening conventional sectors and new green innovative sectors: Technology transfer, skills and capacity are needed in a range of sectors, across government agencies and levels of governance. It will take time to build biodiversity-based industries, but in the long run these will generate revenue while maintaining valuable ecosystem goods and services for a range of sectors. Progress is being made in greening conventional sectors, yet there is a long way to go before all logging concessions practice reduced impact logging and other business sectors follow good management practices.

It is time for the global community to support the development of economies that recognize the true value of forests, not only to support climate mitigation but for the range of resources, ecosystem goods and services that forests provide.

New green, innovative sectors are on the horizon and are starting at small scale. Investments and capacity are needed to help these sectors get off the ground.

Be a resource gateway on natural capital of forests and their provision of goods and ecosystem services: Scientific evidence on the relation between nature and economy is still developing, as are green policies and practices. Additional research is needed to merge basic and applied hydrological, biological, geological and soil sciences with socio-economic theory in order to create to create a powerful tool for integrated management of ecosystems and economies. Such a tool will help to ensure the sustainability, both of the provision of ecosystem services, as well as of their contribution to communities and economies. The international community can support this process, including knowledge sharing regarding methods of strengthening forest governance, creating transparent mechanisms for implementing sustainable forest related agreements, capacity building and a host of other topics relevant to the transition to a green economy.

Stimulate collaboration amongst different actors and improve effectiveness of technical and financial contributions: The international community has the ability to support and influence patterns of commercial and financial engagement. Lending, investment and insurance can be major channels of private financing for a green economy and where possible this process should be encouraged officially.

Role of civil society

Civil society organizations are key actors in the process of sustainable development. Civil society constitutes an arena—distinct from government and the private sector—made of groups, associations and organizations based on voluntary participation. It operates on the basis of shared values, beliefs and objectives, rather than for profit. Civil society actors organize and mobilize themselves in different ways, in cooperation or competition with other forces, and in doing so help secure democratic rules. Civil society can be a source of ideas and can help to monitor development initiatives for their effectiveness in reducing poverty, contributing to green growth and respecting human rights.

An economic and systemic transformation towards greener and more equitable modes of production, distribution and consumption will require the support of a strong civil society to help ensure democratic ownership of the process. In order for a green economy to deliver on its promises of equity, a wide range of civil society voices will need to be heard. A vibrant and pluralistic civil society can contribute to building these green and inclusive development pathways. It can create opportunities and channels through which groups, especially those living in poverty or otherwise marginalized, can influence national development plans, have access to resources and participate in decision-making processes.

Civil society is essential for democratic ownership of a transition towards a green economy.

HoB branding and role of media

A unique, 'HoB brand' of sustainable products derived from the HoB landscape will support the marketing and economic development of the region. It will give local communities and other stakeholders, businesses and governments something to be proud of.

International, national and local media can be a very effective means of promoting the HoB brand and raising awareness among target audiences regarding the importance of investing in natural capital. Media is well placed to spread the message that HoB's natural capital is valuable to people both within and beyond the HoB itself, including the global community.

Media exposure can help to increase awareness of HoB's values, change people's behavior and leverage attention towards the need for policy change and mobilization of fiscal and economic instruments. Media attention can help to stimulate stakeholders, attract new partners and spur momentum.

Media is well placed to spread the message that HoB's natural capital is important not only to people within the HoB but to all in Borneo as well as the global community.

Finally, the HoB is rich with small success stories and lessons learned to be shared with others. The media can be a most effective tool for identifying the concerns and achievements of the people of the HoB and for spreading these messages around the globe.

5.3 CRITICAL STEPS TO SUCCESS

What's in this chapter

- Five critical next steps to accelerate implementation of the green economy approach in the HoB

Swift action by governments and HoB partners is crucial to consolidate and extend recent progress in establishing a green economy.

The intention on the part of each of the three countries to move towards a green economy is evident from national and sub-national planning documents, such as the low-carbon growth plans, green economy corridors and frameworks, state-wide REDD+ plans, etc. Under the HoB Initiative, a convergence of such green intentions would ideally result in the emergence of strategies for green and inclusive growth at the transboundary level—that of the HoB as a whole. Recognizing that regional cooperation can be a long-term process, the HoB Declaration has provided an important starting point in the form of a common vision. A wide range of stakeholders each has a role to play in realizing this vision.

Together, a number of critical next steps are important to accelerate implementation of the green economy approach to deliver sustainable development and conservation in the HoB. These steps hinge in turn on several crucial success factors (see Box 5.6).

Box 5.6: Success factors for a green economy in the HoB[17]

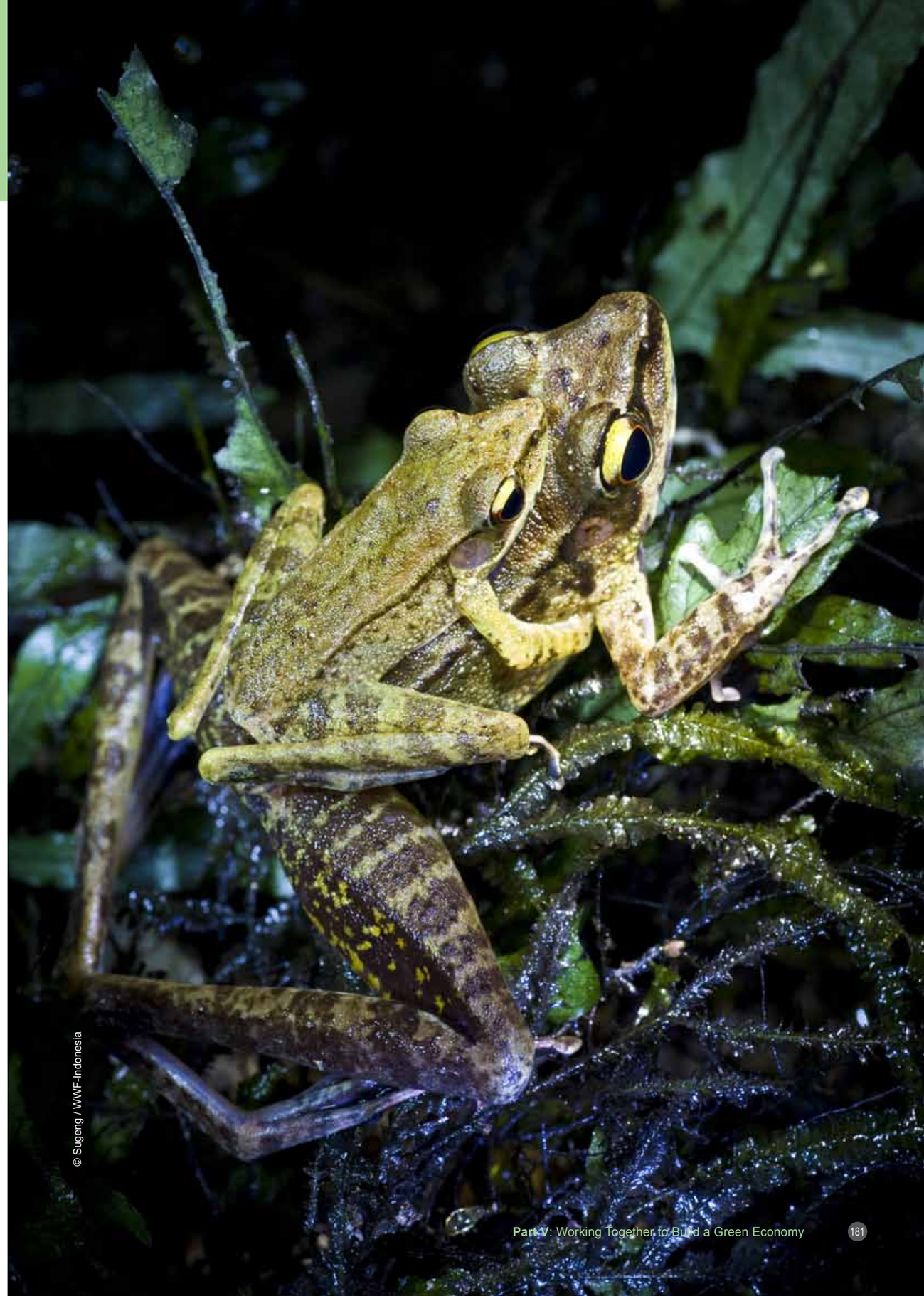
Policy: In this document, policy has been identified as an essential enabler of a green economy, as it provides the rules and boundaries within which economic activity take place. There is currently no overview of how different national and sub-national policies relate to the HoB, nor any mechanism to harmonize these policies within HoB's boundaries.

Analysis and evidence: Policy conducive to green growth needs to be formulated based on solid data, analysis and evidence around a number of crucial questions: How do different types of natural resources and economic growth correlate? What are the non-market values of natural capital to different stakeholders and how are these values influenced by extraction or degradation? What are the long-term implications of specific policies? What are the short-, medium- and long-term costs of specific policy packages, etc.?

Finance: The transition to a green economy will require finance. How much and from which sources will depend on which strategies the HoB governments design and which interventions they choose to implement.

Collaboration: Even with the best policy framework designed, finance, and robust analysis and evidence, not much will happen in the absence of cooperation. Who needs to collaborate with whom and what are the roles and responsibilities of different actors? How can trust and momentum be built?

Skills and knowledge: In the Trilateral Strategic Plan of Action, the three governments specifically acknowledge the need for capacity building to support the Declaration. The transition towards a green economy requires new skills and knowledge on the part of the labour force as well as from civil servants.



Wiser and more inclusive decisions are being made on policies such as REDD+, payments for ecosystem services (PES) and on the development of relevant fiscal and economic instruments and policy packages. However, important challenges remain, including capacity constraints, the continuing reliance on economic growth based on unsustainable natural resource use and the high costs of investing in economic transformation. To be truly successful and transformative, efforts to achieve a green economy will require additional direction, coordination and large-scale implementation support. Changes to policies and practices are urgent, but they need to be based on sound evidence generated through robust analyses, stakeholder engagement and demonstration projects. Taking the above factors as a starting point, the following steps are critical for long-term success:

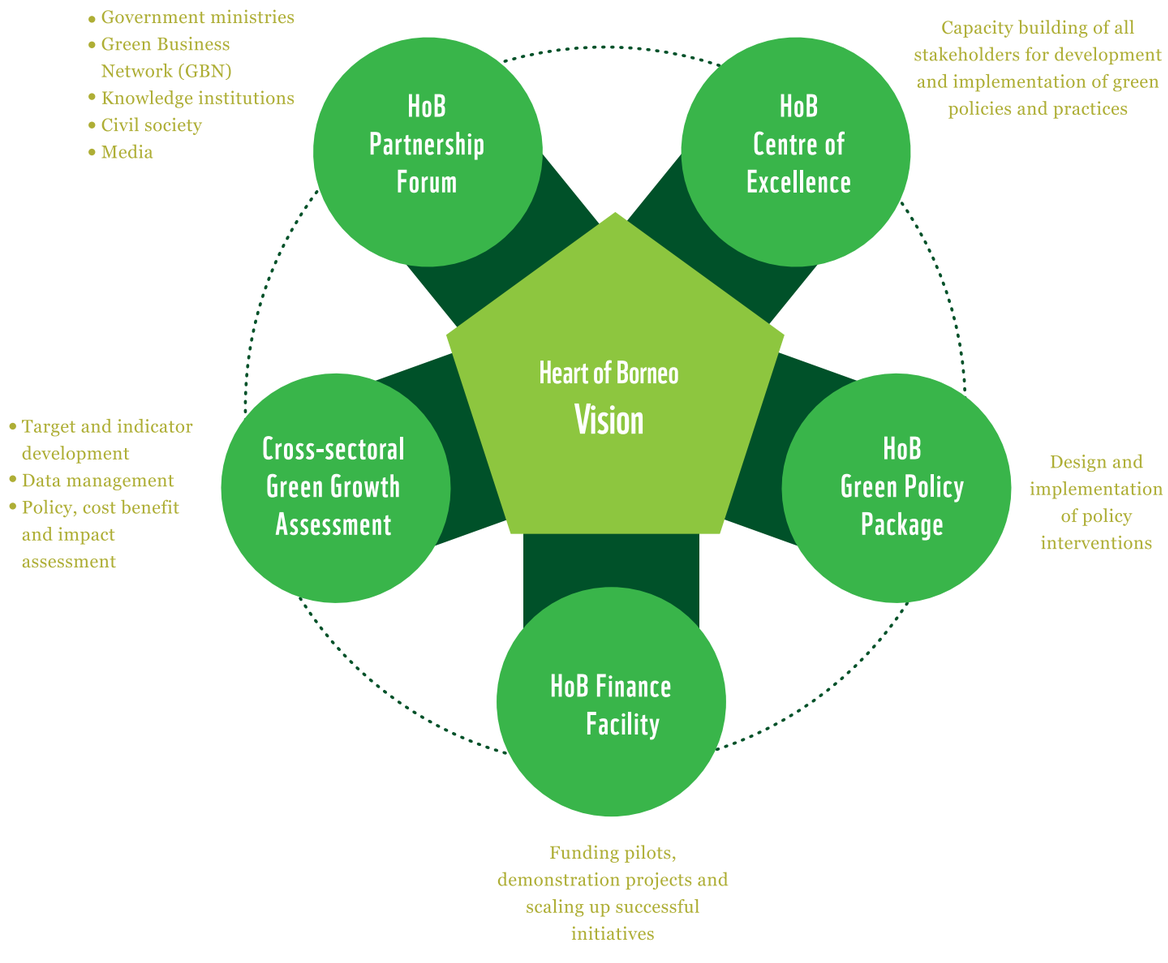


Figure 5.4: Critical steps to success

Heart of Borneo Partnership Forum

A green economy cannot be delivered by a single actor or government institution. It requires partnerships across sectors and among different groups of actors: multi-agency government partnerships can contribute to the enabling regulatory environment, the private sector can contribute to greening their respective lines of business, civil society can contribute by greening consumer demand, etc.

The three governments, both collectively and in some cases individually, have begun a dialogue with key development partners, including multilateral agencies such as ADB, UNDP, UNEP and UN-REDD, as well as with bilateral agencies from Australia, the EU, Finland, Germany, Japan, Norway, Singapore, South Korea, Sweden, the UK, the US and others regarding the future of the HoB. There is an increasing level of awareness of the HoB Initiative at local and national levels and within the global community. Given the growing interest in green economy opportunities and piloting of green growth in the HoB, the time has come to formalize an HoB Partnership Forum, consisting of governments, business and civil society. The forum can facilitate coordinated stakeholder engagement and can be used for information and knowledge sharing, matchmaking, discussion and brainstorming. It can be a forum both for on-the-ground solutions and for strategy development. Developing strategies for a green economy and for planning a process of transition will require specific expertise, in which knowledge institutes (think tanks, research institutes, universities, etc.) can play a decisive role.

Heart of Borneo Center of Excellence

HoB governments, businesses and other stakeholders would benefit from the establishment of a HoB Center of Excellence, which would serve a dual purpose as an information repository and as a training facility. Either physical or virtual, data could be stored, managed and made accessible in one place. This same facility would provide training programs and knowledge transfer in a variety of subjects and skills. As such, the center would build capacity through knowledge management, training and consultancy.

Cross-sectoral green growth assessments (country-specific)

The present report has described the positive impacts of a transition towards a green economy on the economy, people and nature of Brunei, Sabah, Sarawak and Kalimantan; however, more needs to be done to fully appreciate the contribution of the HoB's ecosystems and biodiversity. The resources of the HoB Center of Excellence could be used to support country-specific, comprehensive cross-sectoral green growth sssessments at province/state level that could serve as the basis for a sound HoB policy package. The assessments can be based on models such as the one used in the present report, further refined to meet the specific conditions of the HoB and its unique socio-economic and natural environment.

Heart of Borneo policy package (country-specific)

Despite consensus on a vision for a greener future, and a good understanding of the challenges involved, there is currently no cross-sectoral planning document or policy framework to facilitate a green economy. Further cross-sectoral assessments at national and sub-national levels can provide findings on the basis of which a comprehensive HoB-specific policy package can be designed. The most critical policies involve addressing opportunity costs (economic instruments described in Part IV), securing and clarifying land tenure, managing conflicts and promoting social inclusiveness.

Heart of Borneo finance facility for green growth

The transition to a green economy in the HoB will require substantial finance. An initial fund from which pilots and demonstration projects can be financed will provide evidence regarding what works and what does not work in terms of investing in natural capital and green growth in the HoB. This evidence can be used to attract funds for a macro-scale transition, of which a realistic cost estimation will depend on the kinds of strategies and interventions that will ultimately be implemented.

5.4 AN ALTERNATIVE FUTURE FOR THE HEART OF BORNEO

What's in this chapter

- A carefully constructed roadmap would help to facilitate the joint efforts of the three HoB countries to advance to a green economy that values natural capital

The critical social and economic role of HoB ecosystems is rapidly becoming more widely understood. Ongoing efforts are beginning to demonstrate that a green economy approach to achieving the HoB governments' vision of conservation and sustainable development will lead to more inclusive economic planning, management and accounting within the economies of Brunei, Kalimantan, Sabah and Sarawak.

Shifting to an alternative, green economy which recognizes the value of natural capital is feasible. The potential benefits of such a shift include reduced poverty, more rapid growth, stronger local economies and enhanced resilience to climate change. The essential contributions of ecosystems and biodiversity need to be reflected in national and sub-national economic and development plans based on high-level political endorsement. The above critical steps can become the foundation to a longer term roadmap to deliver the Heart of Borneo Declaration.

The present report has not been designed to present detailed, technical guideline for policy design, for setting fiscal deduction levels, for elaborating payment for ecosystem services schemes or for targeting precise locations of ecosystem service provision. Instead, the report has aimed to demonstrate that an alternative economic approach is feasible and that the HoB landscape is an area where natural capital represents an excellent investment. It is also hoped that this work will contribute to broader discussions and debates concerning the value of nature in a green economy.

The HoB Initiative aims to support the transition to an economy in which the value of natural capital and its importance in climate change mitigation and adaptation are mainstreamed into economic and development decision making. Figure 5.5 provides an illustration of a roadmap towards such a green economy.

HoB Governments made a bold commitment in 2007 to dedicate a significant portion of Borneo as the 'Heart of Borneo'. In so doing, these governments embarked on a road towards a green economy well before many others did; their vision, together with that of a wide range of partners, is worth applauding. Yet many of the most important steps—those needed to ensure the emergence of a truly green economy in the HoB—remain to be taken. By transforming the vision described in the Heart of Borneo Declaration into reality, governments and their partners can create Southeast Asia's foremost green economy.

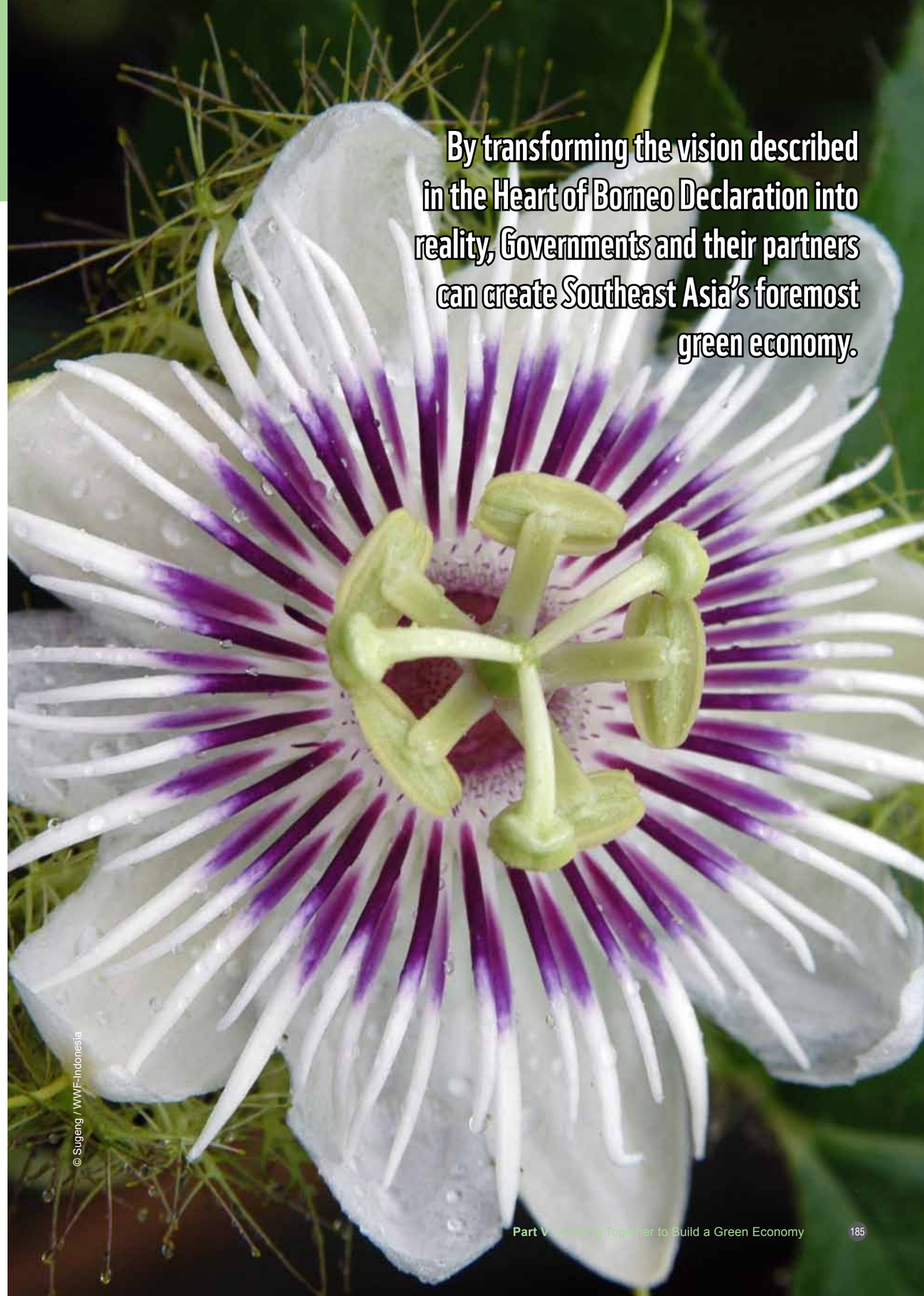
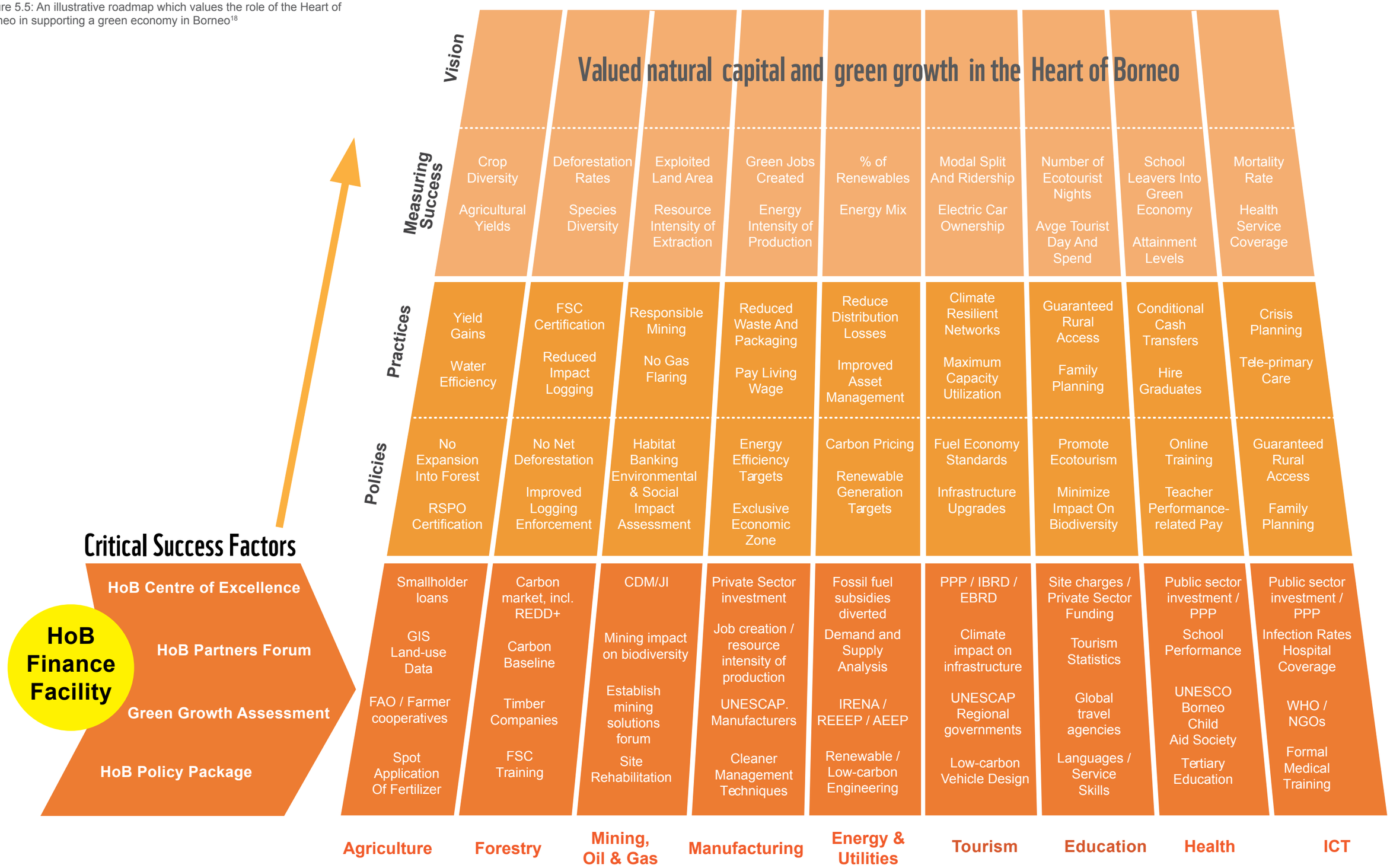


Figure 5.5: An illustrative roadmap which values the role of the Heart of Borneo in supporting a green economy in Borneo[18]



END NOTES PART V

[1] See Annex I for a list of dialogues and workshops which have contributed to this process.

[2] IUCN Shell 2008. *Building Biodiversity Business.*

[3] Sources: Barden, A., Awang, Anak, N., Mulliken, T, and Song M., TRAFFIC International 2000. *Heart of the Matter: Agarwood Use and Trade and Cites Implementation for Aquilaria Mallaccensis*; The Rainforest Project. therainforestproject.net/page6.htm; Mamat M. F. et al. 2010. *Costs and benefits analyses of Aquilaria Species on Plantation for Agarwood Production in Malaysia.* Centre for Promoting Ideas; The potential of Gaharu as Plantation species. http://www.epicpalms.com/management-of-agarwood; http://www.gaharuonline.com

[4] HoB GIZ FORCLIME Project.

[5] All international companies in Indonesia have the objective to achieve fully sustainable cocoa production by 2020; the demand for certified cocoa is likely to grow over time.

[6] Sources: Department of Fisheries Sabah, Malaysia 2012. *The Tagal Initiative; The Borneo Post, 20 July 2011. Government to devise Empurau Master Plan; FAO. 2012. Fisheries and Aquaculture*, website: Impacts of aquaculture on environment and National Aquaculture Legislation Overview Malaysia; The Star on-line, 10 March 2011. Business section, website: LTT Aquaculture to boost empurau exports; The Borneo Post on-line, 6 May 2011. *Agro-tourism Packages for Bakum and Murun*; Wurts 2000. Reviews in Fisheries Science, 8(2): *Sustainable Aquaculture in the Twenty-First Century*; Aquaculture Asia October-December 2004. (Vol. IX No. 4) *Artificial propagation of the indigenous Tor species, empurau (T. tambroides) and semah (T. douronensis), Sarawak, East Malaysia*; Frankic, Hershner 2001. *Sustainable aquaculture: developing the promise of aquaculture*.

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[15] Starling Resources & WWF 2010. *Feasibility Assessment Report for Financing the Heart of Borneo Landscape*. Three reports for each HoB country. Brunei, Indonesia (Kalimantan), Malaysia (Sabah and Sarawak).

[16] http://wwf.panda.org/what_we_do/where_we_work/borneo_forests/borneo_rainforest_conservation/greenbusinessnetwork/

[17] WWF and PWC. 2011. *A Roadmap to a Green Economy in the Heart of Borneo: a scoping study.*

[18] *Ibid*

ANNEX I: HEART OF BORNEO GREEN ECONOMY STAKEHOLDER ENGAGEMENT PROCESS

This report is based not only on the findings of analytical analyses and modeling tools, but most importantly it is the result of a participatory-based approach through various green economy related workshops, dialogues and conferences at national and regional level. A range of stakeholders from national and sub-national governments, businesses, development partners, academia and civil society have supported this ground-breaking initial work to develop appropriate scenarios, define drivers and cause-effect relations, collect and collate data inputs, develop HoB-specific policy options and relevant economic instruments, as well as on-the-ground and cross cutting interventions, targets and indicators. Some of the most relevant events are briefly described below.

October 2010: COP10 UN Convention of Biological Diversity in Nagoya, Japan

At the tenth Conference of the Parties (COP) of the Convention of Biological Diversity, held in Nagoya, Japan, the three HoB governments hosted a side event and launched their joint publication: *Financing the Heart of Borneo - A Partnership Approach to Economic Sustainability*. During this launch, the governments announced their intention to pursue the following next steps:

- Understand the value of forests, watersheds, biodiversity and potential for carbon emission reduction and distribution to beneficiaries;
- Assess how to optimize economic growth while maintaining HoB's natural capital and its contribution to climate change;
- Estimate the costs and benefits associated with sustainable landscape management.

Following the Nagoya meeting, a series of workshops and dialogues—along with development of the present report—were all done in support of the above next steps.

Dr Ahmed Djoghlaf, the Executive Secretary to the UNCBD joined the three Bornean governments to co-launch their publication: Financing the Heart of Borneo - A partnership approach to economic sustainability atthe HoB side event at the UNCBD-COP10, 25 October 2010.

December 2010: Kick-off workshop 'The Economics of Biodiversity and Ecosystem Services to Guide Policy, Finance and Private Sector Decision-making in the Heart of Borneo Landscape'

Participants from a range of sectors, joined the 3 day workshop in Jakarta to have an improved understanding of the fundamental value of biodiversity and ecosystem services within a green economy development path.

A three-day, kick-off workshop was held in December 2010. The first day focused on the HoB approach to building a green economy, while the following days were devoted to presentations and discussions about InVEST (Integrated Valuation of Ecosystem Services and Trade-offs), a GIS tool which maps out and assesses the value of biodiversity and ecosystem services within a given landscape. Among the 55 participants were several development partners (UKCCU, DFID, FAO, UNDP, UN-REDD), Government agencies (Indonesia's Coordinating Ministry of Economic Affairs, and Ministry of Environment, Forestry and Public Works) and WWF staff (international, national and Borneo-based). The workshop began the process for partners to develop a range of 'scenarios' to help predict potential future development alternatives in the HoB.

2010-2012: Green economy public debates in the Heart of Borneo

Over a period of 18 months, WWF-Indonesia has organized a number of structured dialogues among civil society, experts, and local government in the HoB to increase understanding and mainstreaming of issues related to green economy, good governance and sustainable development. Supported by WWF-Sweden and SIDA, these public debates, or dialogues, provided an important platform to share information, improve understanding and strengthen participation in political and decision-making processes at all levels. They also were helpful in establishing the basic principles and strategies in support of pro-green and pro-poor development in Kalimantan (Indonesian Borneo), where the green economy concept was relatively new. The dialogues were tailored to bridge a common gap in information and action between levels of government, and among governments, think tanks and academic institutions, and civil society, especially local communities.

Group discussion on green economy alternatives during the public debate in Palangka Raya, Central Kalimantan province, January 2011.

Green economy experts chat with the Governor and high officials of Central Kalimantan Province. Central Kalimantan in the pilot project province for LOI with Norway on REDD.

Civil society representatives at the public debate in Palangkaraya, Central Kalimantan province, January 2011.

Three events have been organized so far, at district and provincial levels in West, Central and East Kalimantan, attended by over 600 people altogether. Coalitions of civil society organizations and community-based organizations worked together with WWF, experts from academic institutions and the government to ensure meaningful discussions, exploration, and visioning for the future of the HoB. Issues discussed included: identification of alternatives for pro-poor and pro-green economies to provide input for the drafting of district government mid-term development plans; social and environmental safeguards and food security for future economic growth; fiscal incentives for green economy; communities' role in securing access and good governance of natural resources, including conservation. The events represented catalytic moments for generating awareness and commitment of organizations, local institutions, local and central governments and community groups around sustainable development and green economies in the HoB.

2010-2011: Development of the Central and East Kalimantan provincial low carbon green growth strategies

The National and Regional Councils on Climate Change led the development of the Central and East Kalimantan provincial low carbon green growth strategieswith technical, analytical and funding support from McKinsey & Company, as well as several other public institutions, expert organizations and NGOs. Spatial and other data from the HoB contributed to the development of these green growth strategies and helped to inform stakeholder dialogues and decision-making processes. In turn, the provincial plans have been used as technical and policy inputs to the HoB green economy assessments.

March - April 2011: Workshops on developing a green economy district program for Kutai Barat

In March, Kutai Barat (Kalimantan) district officials participated in a workshop in Sendawar, to develop a common understanding of the green economy concept and to deliberate its implications at district level. Mr Didik Effendy, Vice Head of Kutai Barat District, highlighted the importance to support the communities of Kutai Barat to be smart, healthy, productive and prosperous in order to achieve sustainable development in Kutai Barat. A priority collaboration between Kutai Barat District Government and WWF is community-based socio-economic development and minimizing environmental impacts in economic activity. This was followed by a second workshop in Balikpapan in April, involving provincial- and district-level government officials, WWF and several partner organizations.

Left picture:
From left to right: Anwar Purwoto, Forest Director WWF-Indonesia, Didik Effendi, Vice Head of Kutai Barat District and Bruce Cabarle, WWF Forest and Climate Global Initiative discuss the relevance of a green economy approach at district level.

Right picture:
Dr. Paulus Matius (center), former head of Kutai Barat district Forestry Agency, engages in a collaborative dialogue with partners

April 2011: Heart of Borneo Green Business Network Forum at the Business for Environment (B4E) Summit, Jakarta

Keynote address by former US Vice President and Nobel Laureate, Al Gore, at the 2011 Business for Environment (B4E) Forest Dialogue dinner event on January 9, 2011, the forerunner to the world's leading international conference for business-driven action for the environment—the B4E Global Summit.

Indonesian president H. E. Dr. H. Susilo Bambang Yudhoyono backs Green Economy approach.

Heart of Borneo takes center stage at B4E Global Summit 2011 in Jakarta.

Business for the Environment is a leading international platform for dialogue and partnership solutions for the environment. The B4E summits bring together world leaders, CEOs, senior executives and industry experts to share ideas and agree on strategies to address the most urgent environmental challenges facing the world today. At the B4E Summit in Jakarta in 2011, the HoB Green Business Network forum gathered to establish stronger links among business, government, investors and donors to deliver sustainable practices across the 40 per cent of the HoB under industry or business concessions. A range of sectoral workshops was held (mining, palm oil and logging) to discuss key fiscal incentives and policies necessary for transformation of these key sectors toward responsible management and operations.

The following individuals, companies and organizations participatedin the B4E HoB Green Business Network Forum:

Juhri Bin Darlan (PT. Kapuas Maju Jaya)
Berry Adek (AFP)
Adi Daskian (PT. Rizki Kocida)
Andi Mukhsin (PTFI)
Wardhana Asoka (BNI)
Sahi Avi (NIKE)
Sahari Bandung (PT Astra agro lestari Tbk)
Monument Austair (FSC)
Paul Bardlof (Yayasan Tambuhak Sinta)
Dwi S.Bambang (GKU)
Edison Bong (PT Graha Kerindo Utama)
Bryant Christanto (Credit Suisse)
Budi Irianto (Rio Tinto)
Budi Kuncoro (TNC)
Bustar Maitar (Green Peace Indonesia)
Novianto Herupratomo (PT Garuda Indonesia)
Carey Yeager (USAID)
Cassandra Graman (Eco Business)
Chin Miew Lim (Global Environmental Choice)
DR. J. Kisjanto (PT Horison Abadi)
Sanjay C. Kuttan (Det Norske Veritas)
Untung Iskandar (PT. Narkata Rimba dan PT. Belayan River Timber)
Eddy Iriyanto (PT Rizki KP)
Emirsyah Satar (PT Garuda Indonesia)
Erik Habers (EU Delegation)
Exal Halamish (Futureye)
Franziska Zimmermann (Syngenta)
Gatut Surjokdjo (Belayan timber Tbk)
Gopinath Menon (PT PricewaterhouseCoopers Indonesia Advisory)
Grace Luo, (ITRI)
W. Gunung, (PT SGS)
Guy Escarfail (PT SGS)
Harmon Yunaz (PT. Idonesia Asahan Aluminium)
Hega Ragnhildshoeit (Norwegian Embassy)
Herman Prayudi (APHI)
Heru Wardana (PT MPJ)
Ibw Putra (PT SJM)
Ice Isma Nettamura (PT Roda Mas Group)
Zainal Poeloengan (PT. Swakarsa Sinar Sentosa)
Yudhi N (PT KEM)
Yono Rekso Prodjo (Kadin LHPI)
Yearline QD. Ristiady (Darmex Agro)
Yana (Kayu Lapis Indonesia Group)
YAMAUCHI Hiromi, MPS (JICA)
Yakobus Stef M (Agro indonesia)
Xavier Matton (GTHNICRAFT)
Wisnu Susetyo (PTFI)
Prof. J. Kisjanto, MD.PhD (PKWI)
Raphael Kodrata (IPC)
Rini Sulaiman (Norwegian Embassy)
Rizal B (TBI)
Rizki Amelia Lubis (Bakrie Sumatera Plantations)
Rob Daniel (British Embassy)
Rob Evans (PwC)
Rolf Krezdorn (GIZ Forclaime)
Rona Dennis (BHP Billiton)
Rudy Gunawan (PT. Sumalindo Lestari Jaya)
Safrizal Akbar (Kadin Indonesia)
Sartono (Komisi Minyak Sawit Indonesia)
Silvia Sari Pulungan (Bakrie Sumatera Plantations)
Siti Kasanah (Perum Perhutani)
Slamet W (APHI)
T. Notosuroto (PT Swakarsa)
Teh Choon Bok (PT. Pasifik Agro Sentosa)
Tony Soesanto (Artha Graha Peduli)
Wahyu Ikhsani (PT Ratah Timber)
Walter North (USAID)
Wen-Ling Chiu (Institute of Environment and Resources)

August 2011: Kalimantan Green Economy Corridor Workshop

More than 40 representatives from the public and private sector, as well as selected NGOs, launched an innovative project to define green growth options in Kalimantan (Indonesia). Organized by the Presidential Unit for Development Monitoring and Oversight (UKP4), supported by the United Nations (UNEP, UNDP and UN-REDD), WWF as well as other leading organizations, the multi-stakeholder workshop had two parts. In the first, high-level policy makers discussed how REDD+ could act as a catalyst for a green economy promoting sustainable economic growth; the second part dealt with technical discussions on tools and methods to achieve and integrate objectives of the Kalimantan green economy corridor. This included biophysical, social and economic data requirements and the development of scenarios detailing options for moving from 'business as usual' to a 'green economy'. The Causal Loop Diagram (CLD) for the economic and environmental modeling of Kalimantan was developed during this workshop to identify relevant feedback loops, as well as entry points for green economy solutions.

September 2011: The fifth Heart of Borneo (HoB) Trilateral Meeting and HoB Partners Forum with an emphasis on a green economy approach

Prof. (Hon.) Rachmat Witoelar – President's Special Envoy for Climate Change and Executive Chair on the National Council on Climate Change Indonesia opened the HoB Partners Forum in Balikpapan, East Kalimantan.

Following the official inter-governmental meeting between Brunei, Indonesia and Malaysia, held in Balikpapan on September 21- 22, 2011, a multi-sectoral group of partners were invited to attend a dialogue on the role of the HoB's natural resources and ecosystems in the (remove the) future economic development. The intention was to foster stronger and more coordinated engagement in support of green growth in the Heart of Borneo. The opening session was led by Prof. (Hon.) Rachmat Witoelar – President's Special Envoy for Climate Change and Executive Chair on the National Council on Climate Change Indonesia. The dialogue concluded with an agreement that the HoB is a "natural priority" for developing a green economy approach and therefore would be a focus of collaborative efforts in the lead up to and during the Rio+20 Summit in 2012.

November 2011: Sabah Green Economy Summit

More than 500 representatives of business, government, civil society and multilateral development organizations gathered in Kota Kinabalu, Sabah on Nov 15-16, 2011, for the "Sabah Heart of Borneo (HoB) Green Economic Development - Engaging Business for Environment" summit. The two-day conference, convened by the Sabah Forestry Department and co-hosted by WWF and UNDP, attempted to demystify the green economy concept by:

- gaining a common understanding of the real meaning of green economy compared to business as usual;
- understanding the economic contribution of HoB's natural capital to Sabah's development agenda;
- sharing knowledge on green economy incentives and the policy mechanisms needed to encourage these activities; and
- mapping out a strategy, or road map, for a consolidated approach to realizing a green economy in the HoB landscape.

From left: Mr Mahmud Haji Yussof (Chief Executive Director of Brunei Darussalam HoB Centre and Deputy Director, Ministry of Industry & Primary Resources, Brunei), H.E. Mr Ong Keng Yong ((High Commissioner of Singapore High Commission in Kuala Lumpur), Dr Andi Novianto (Chaiperson, Indonesia HoB National Working Group), Dr Nazily Mohd Noor (Chief Executive Officer, Malaysian Green Technology Corporation) and Puan Mary Sintoh (Vice-President of Knowledge and Technology, Management Division, Sabah Economic Development and Investment Authority (SEDIA)).

WWF Malaysia's Executive Director/CEO, Dato Dionysius Sharma and HoB Leader, Adam Tomasek, explain to the Chief Minister, WWF's strategy for support of a green economy in the HoB at the WWF's conference booth.

Datuk Sam Mannan, Director of Sabah Forestry Department presents Sabah Forestry Department plans to promote a green economy in Sabah.

January - March 2012: The Economics of Ecosystems and Biodiversity in ASEAN – Policy Dialogue

The HoB as an emerging example of green economy approaches was profiled in a series of dialogues with officials from across the ASEAN region in order to disseminate and develop national capacity on the TEEB approach ("The Economics of Ecosystems and Biodiversity") for ASEAN countries. The project engaged senior-level policy and decision makers to recognize the economic benefits and values of ecosystems and biodiversity; understand the costs of biodiversity loss; and take actions to incorporate these values into national plans and budget. The dialogues were supported by the UK Foreign and Commonwealth Office, ASEAN Centre for Biodiversity and UNEP.

February 2012: Indonesia Heart of Borneo National Working Group Meeting and Sustainable Finance Small Team Workshop

Findings of the draft HoB Green Economy report were presented to the Indonesia Heart of Borneo National Working Group, chaired by the Coordinating Ministry of Economic Affairs. The working group, which consists of members from 11 Ministries at national and sub-national levels, participated in this meeting to discuss the approach and findings of the report. Following this meeting, a further detailed discussion was held with the HoB Sustainable Finance Small Team with members from the Ministry of Finance, Investment Board, Environment, Forestry, Agriculture and Mining and Energy to identify suitable policy packages and relevant economic instruments for the HoB. Next steps include discussions with national and local universities to support the HoB National Working Group in development of targeted economic policies linked to the HoB Strategic National Area.

March 2012: Green Economy expert workshop

Annawati van Paddenburg, WWF Project Leader of the Heart of Borneo: Investing in Nature for a Green Economy report, shares the key messages of the draft report with global experts in Geneva, March 2012.

As the present report neared completion, a focused, hands-on workshop was held in Geneva in late March 2012 to engage key staff from UNEP, UNEP-TEEB, FAO, IUCN, Green Economy Coalition and the global WWF Network. Experts representing natural capital valuation, policy development, macroeconomics, ecology and communications came together to review and improve the contents of the report.

April 2012: Green Economy Roundtables - Pathways to a Sustainable Future (Singapore and Jakarta, Indonesia)

The roundtables, co-hosted by the Association of Chartered Certified Accountants (ACCA) and WWF,brought together policy, business and investment perspectives critical to enabling green economies. The roundtables explored opportunities, challenges and priorities for creating that future, while highlighting a number of key steps:

- changing resource use trends;
- maximising investment in people;
- developing a fruitful and sustainable engagement with the business community;
- finding new growth models in Indonesia and other parts of Asia to influence public policy, collective efforts and common vision.

April 2012: Heart of Borneo Forum - Green Economy for People, Planet and Prosperity

During the month-long HoB Festival in Jakarta, Indonesia, the three-day HoB Forum provided a venue for further discussion of policy and incentives, economic and business aspects of building a green economy in the HoB. WWF and UNDP co-hosted a breakfast dialogue with ambassadors, diplomats and senior officials from 25 embassies, agencies and/or multilateral organizations, including the UN, World Bank, Asian Development Bank, to forge commitments for the support of green economy initiatives in the HoB. Opening the dialogue, Professor Dr. Emil Salim, leading economist, former Indonesian Minister and currently chairperson of President Yudhoyono's advisory council, highlighted HoB's importance and the need for further action to achieve its goals.

Pathways to a sustainable future' was the key theme of the Heart of Borneo Forum's Green Economy Roundtable, co-hosted by the Association of Chartered Certified Accountants (ACCA).

Pavan Sukdev, leader of the Global TEEB Initiative shares his remarks via a video opening address at the HoB Forum 'Incentives for a green economy' session.

Pof Dr. Bustanul Arifin, a well-respected academic and public figure in Indonesia speaks on the mainstreaming of ecosystem services into development policies at the HoB Forum in April 2012.

The value of nature to Indonesian business was the subject of a debate co-hosted by WWF and the Association of Low Carbon Industries (ALBI). Dr Joshua Bishop, lead editor of The Economics of Ecosystem and Biodiversity (TEEB) in Business and Enterprise, led a discussion on implications for Indonesia, with particular reference to the vast natural capital asset that is the HoB. The youth voice was also heard, with schools from throughout Jakarta competing for a place in the final of the 'Great Green Economy Youth Debate'. Indigenous leaders and performers from the HoB also used the occasion to raise their political voice to help define future priorities for their homelands. Their close connection to the forests of Borneo was highlighted through a series of cultural events at the Festival of Borneo, staged in one of Jakarta's biggest malls.

ANNEX II: TESTIMONIES FROM THE PEOPLE OF BORNEO

IMPACTS OF UNSUSTAINABLE LOGGING ON LIVELIHOODS

Anye Apui, Customary Chief of Hulu Bahau, Malinau, East Kalimantan, Indonesia, fears for the future of his people if their forests are destroyed: "Timber is gold, but this is not the kind of gold that is good for us. I want to protect the forest in my area, as the forest is life for Dayak people".

IMPACTS OF PALM OIL EXPANSION ON WATER QUALITY AND SUPPLY

Lukas Subardi, Director of Sanggau, local-government-owned drinking water utility, West Kalimantan, Indonesia: Lukas is concerned by the rapid expansion of palm oil plantations in West Kalimantan: "In the dry season, all of the smaller rivers are dry due to the endless deforestation of the Kapuas natural forest…in the rainy season, the river water is very turbid and heavily polluted by waste from leaching chemicals such as herbicides, pesticides, industrial waste, sludge, silt, etc…all due to expansion of oil palm upstream." (Lukas's blog is at http://pdamsanggaukapuas.blogspot.com/)

IMPACTS OF FLOODING

Farmers in East Kalimantan can't afford floods. Udin, a farmer in Sebatik, Nunukan, says that "the shallow river…cannot manage heavy rainfall, the river overflows and our fields are inundated with water. We have only managed to sell 20% of the harvest. A loss of hundreds of millions of rupiahs for us farmers." There are also the social and environmental impacts – landslides, floods, houses destroyed and no electricity.

IMPACTS OF MINING ON WATER QUALITY

Sumadi, 45, moved to Desa Harowu, District Gunung Mas, Central Kalimantan, Indonesia, over 15 years ago. Most of the villagers are now engaged in gold mining for a livelihood: "Mining has thoroughly contaminated the river and destroyed its quality as well as causing damages everywhere. As for the impacts, most of the rivers in which mining occurs can no longer provide other benefits, such as fish and drinking water for the community. This situation was very different 15 years ago, when there was no mining. We were able to catch fishes easily. We could even see fish from the surface of the river. Children could swim along the river at that time. I had often to drink the water directly from the river. Now, on one dares to drink the water from the river, because of the health impacts. Oh, how I wish could bring the past back with us to the present time".

CLIMATE WITNESS

Mohamed Jerome Robles, 37, Miri, Sarawak, Malaysia: Mohamed has observed the impacts of a changing climate in Miri, Sarawak: "There does not seem to be a distinct monsoon season anymore. The rain is more frequent, random and certainly more intense….now we are afraid of flash floods and strong winds which accompany the intense rains."

ANNEX III: METHODOLOGY AND REFERENCES USED IN REDUCED IMPACT LOGGING ANALYSES RELATED TO CARBON SEQUESTRATION AND SEDIMENT RETENTION

Above ground biomass map of Borneo (SARVISION, 2011) was used to derive average above ground carbon stock of all active and inactive forestry concessions on the Indonesian side of the HoB. The intent is to highlight the potential carbon gains from managing past or future concessions with the best management practices that can improve carbon retention of a working concession by up to 20-30 per cent (Pinard and Putz 1996, Putz et al. 2008b). To calculate the potential additional carbon we assumed that the concessions with a performance management score of very good (GFTN, 2009) were performing at their maximal carbon retention. For the 78 concessions having management performance scores, the additional carbon that could be stored was a function of the existing above ground biomass and the score. Concessions with a "very good" score were assumed to be performing at their potential, while concessions with apoor rating were assumed to have the potential to improve stores by 30 per cent. Fair and good concessions were assumed to be operating at 20 per cent and 10 per cent below their full potential, respectively. The 80 concessions for which performance scores were not available were assigned the mean score of the concessions with scores.

For market values, we used the European Trading Scheme price point for carbon (accessed 19 Jan 2012). For the social value of carbon, the figure used was US$21 per tonne of CO_2, as per the United States Social Cost of Carbon Regulatory Impact Analysis (2010). Two alternative cost assumptions were: 1) no net additional cost of management and 2) an additional cost of US$ 790/ha as calculated for moving from conventional practices to improved forestry management techniques in lowland dipterocarp forests in Malaysia (FRIM 2001).

For the sediment retention analysis, the InVEST sediment retention model was used. Management assumptions were made to compare sediment retention parameters under the Business-as-Usual (BAU) scenario to improved ones under the Green Economy (GE) scenario. Specifically, the cover and management factor, management practice factor, and sediment retention efficiency were changed, respectively, from 10, 50 and 80 per cent to 50, 50, and 80 per cent for primary forest cover and from 50, 50 and 70 per cent to 10, 50 and 70 per cent for secondary forests.

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Further details on methodology can be found at www.hobgreeneconomy.org

ANNEX IV: ADDITIONAL BIBLIOGRAPHY AND DATA SOURCES OF SYSTEMS DYNAMICS MODELING

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ANNEX V: ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
APBD	Anggaran Pendapatan dan Belanja Daerah
ASEAN	Association of Southeast Asian Nations
BAU	Business As Usual
BIMP-EAGA	Brunei Darussalam, Indonesia, Malaysia and the Philippines East ASEAN Growth Area
BOD	Biological Oxygen Demand
CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species (of Wild Fauna and Flora)
CL	Conventional Logging
CLD	Causal Loop Diagram
CSR	Corporate Social Responsibility
DID	Dana Insentif Daerah (Regional Incentive Fund)
GDP	Gross Domestic Product
GE	Green Economy
GIS	Geographic Information System
GHG	Greenhouse Gas
EIA	Environmental Impact Assessment
ESA	European Space Agency
ETP	Economic Transformation Program (Malaysia)
FI	Financial Institutions
FIP	Forest Investment Program
FPIC	Free Prior Informed Consent
HEP	Hydro Electric Power plant
HoB	Heart of Borneo
HoB PIF	Heart of Borneo Project Implementation Framework (Brunei Darussalam)
HoB GBN	Heart of Borneo Green Business Network
HCVF	High Conservation Value Forests
IBRD	International Bank for Reconstruction and Development
ICMM	International Council on Metals and Minerals
InVEST	Integrated Valuation of Environmental Services and Tradeoffs
IUCN	International Union for Conservation of Nature
JICA	Japan International Cooperation Agency
KSN	Strategic National Area (Indonesia)
LCM	Land Change Modeler
LNG	Liquefied Natural Gas
LOI	Letter of Intent
MDB	Multilateral Development Bank
MDF	Mixed Dipterocarp Forests
MDG	Millennium Development Goals
MEA	Millennium Ecosystem Assessment
MIPR	Ministry of Industry and Primary Resources (Brunei Darussalam)
MP3EI	Master Plan for the Acceleration and Expansion of Economic Development of Indonesia
NDP	National Development Plan
NEM	New Economic Model (Malaysia)
PA	Protected Area
PBLS	Projek Barat Laut Selangor
PDAM	Perusahaan Daerah Air Minum (Local Drinking Water Utility (Indonesian))
PES	Payment for Ecosystem services
POME	Palm Oil Mill Effluent
NTFP	Non-Timber Forest Products
R&D	Research and Development
REDD	Reducing Emissions from Deforestation and Degradation
REDD-I	REDD Indonesia
RAN-GRK	Presidential decree on national action plan to mitigate GHG emissions (Indonesia)
RIL	Reduced Impact Logging
RPJM	Medium term Development Plan (Government of Indonesia)
SCORE	Sarawak Corridor of Renewable Energy
SDC	Sabah Development Corridor
SIDA	Swedish International Development Cooperation Agency
SOM	Soil organic matter
SRI	Strategic Reform Initiatives (Malaysia)
TEEB	The Economics of Ecosystems and Biodiversity
TFP	Total Factor Productivity
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UNCSD	United Nations Conference for Sustainable Development
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UN SEEA	United Nations System of Environmental-Economic Accounting
WHO	World Health Organization
WWF	World Wide Fund for Nature

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Ban Ki-moon,
UN Secretary-general

"Based on our collective experiences, the best way to enhance the framework for strong, sustainable and balanced economic growth is to put development front and centre,and to invest in a green economic recovery for all."

Al Gore at The Business 4 Environment Summit, in Jakarta (2011)

"A Green Economy may not be the easy choice today, but history will show that it is the right choice."

Pavan Sukdev,
Leader of the 'The Economics of Ecosystems and Biodiversity' (TEEB) Series

"We are probably the first generation of leaders who have the chance to take decisive action and probably the last generation who have the option not to do so."

Susilo Bambang Yudhoyono,
President of Indonesia

"I believe Indonesia can implement green economy to achieve 7% economic growth and 26% reduction of greenhouse gas emissions by 2020."

HRH Prince Hj Al-Muhtadee Billah,
The Crown Prince and Senior Minister at the Prime Minister's Office, Brunei Darussalam

"Best practices in development projects in use must be strengthened to ensure that they take into account the priority to preserve the environment. This is consistent with our aspiration to build on the strong image of Green of Brunei Darussalam."

Datuk Zakri,
Science Advisor to the Prime Minister of Malaysia

"Developing countries are falling behind in the fight against their deteriorating environment. They are rapidly losing their natural resources and ecosystem services, being the foundations for their economies, because they have not put in place a national environmental governance system."

ISBN 978-602-19901-1-7

Printed on 100% recycled paper